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CANADIAN
ELECTRICAL NEWS
AND ENGINEERING JOURNAL

OLD SERIES, VOL. XV —No. 8.
NEW SERIES, VOL. X.—No. 1

JANUARY, 1901

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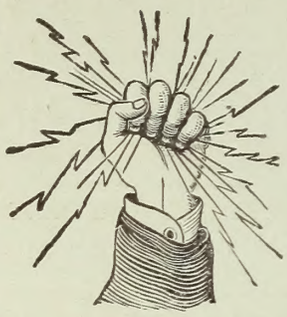
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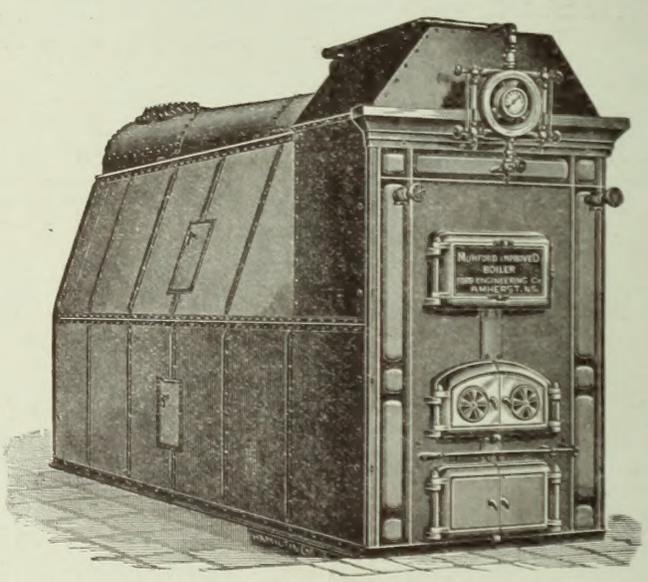
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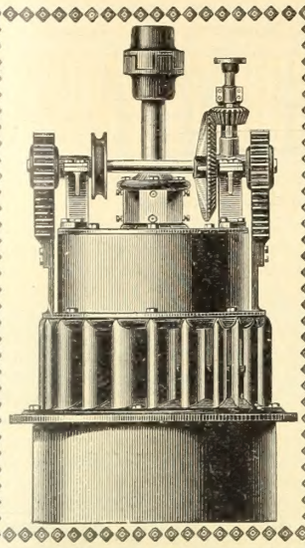
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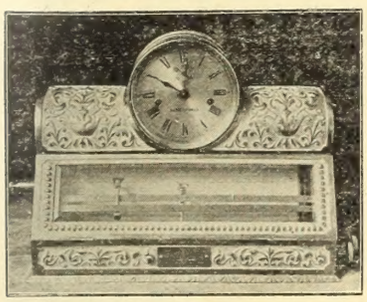
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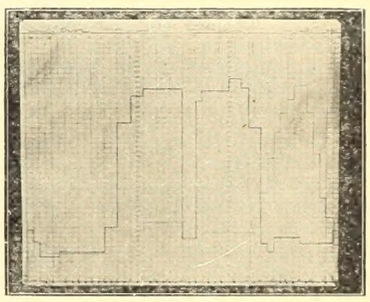
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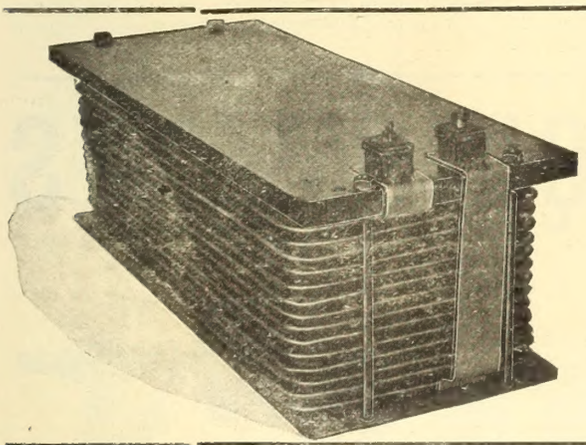
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MESSRS. GOLDIE & McCULLOCH,
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GENTLEMEN,—In reply to your favor of the 15th inst., re the Wheelock engine lately replaced by a larger one by your firm, we have pleasure in stating that we ran the engine in connection with our electric light works constantly for over eight years, during the whole of which time we never had occasion to shut down while running, nor did the engine cost us one cent for repairs.

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PERSONAL.

Mr. J. W. McRae has resigned as managing-director of the Ottawa Electric Light Company.

Mr. Thomas Proctor, city electrician of New Westminster, B. C., has tendered his resignation.

Mr. H. McCullough, of Winnipeg, has accepted a position with the Lethbridge, Man., Electric Light & Waterworks Company.

Mr. John Bird, for many years assistant engineer at the waterworks pumping station, Hamilton, died suddenly a fortnight ago.

Mr. Warren Y. Soper, of the electrical firm of Ahearn & Soper, Ottawa, returned last month from a tour in New Mexico and California.

Mr. W. B. Hall, chief engineer of the high-level waterworks pumping station, Toronto, recently slipped on the sidewalk and received injuries which resulted in his death.

Messrs. W. T. Jennings, C. E., of Toronto, R. A. Ross, E. E., of Montreal, and G. R. Mickle, B. A., have been appointed a board of examiners in the engineering department of Toronto University.

English papers to hand announce the death at Grasmere of Prof. Frederick George Armstrong, who in 1871 was appointed first professor of engineering in the new applied science school at McGill University, Montreal. Five years later he returned to England, where he has occupied important positions.

Mr. C. N. Ryan, of the Toronto Railway Company, has accepted an important position in Sao Paulo, Brazil, in connection with a street railway system to be built there by Canadian capitalists. Prior to his departure from Toronto he was presented with a handsome gold watch by a number of his friends.

Mr. Robert A. Ross, E.E., of Montreal, sailed on the 22nd of December for Russia. Mr. Ross will be absent for some months, having received a commission to report upon an important power transmission and upon railways and lighting for a large city in that country. The numerous friends of Mr. Ross will be pleased to learn of his success in this direction.

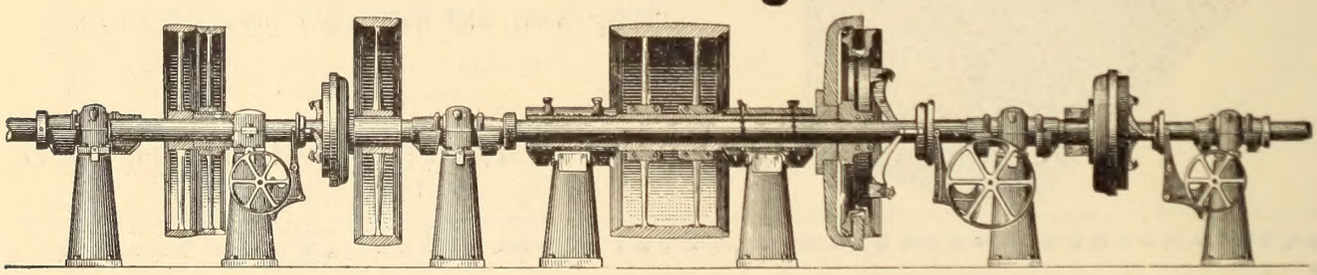
Mr. H. H. Gilmour, for the past seven years superintendent of the Waterous Engine Works Company, at Brantford, Ont., has severed his connection with that firm and accepted a position with the Canadian General Electric Company at Toronto. Before leaving Brantford he was made the recipient of a set of silver table cutlery by the employees of the Waterous Company, and of a gold-headed ebony cane, suitably engraved, by the apprentices of that establishment.

Mr. R. V. Bingay, who for the past five years has filled the position of superintendent of the transformer department of the Packard Electric Company at St. Catharines, Ont., recently tendered his resignation. To mark the esteem in which he was held the employees of that department, to the number of about thirty, tendered him a banquet at the Grand Central Hotel in St. Catharines. Mr. George Flack was master of ceremony. On behalf of the employees he read a complimentary address and presented Mr. Bingay with a beautiful gold locket and chain. Mr. Bingay made a neat speech in reply, referring to the pleasant relations that had existed between himself and his employees.

The acquisition by the Canadian General Electric Company of the manufacturing department of the Royal Electric Company has necessitated a number of important changes in the staff. Mr. E. G. Patterson becomes general superintendent of the Peterborough works as successor to Mr. C. A. Barton, who has resigned. Mr. Hazen Ritchie has been transferred from Peterborough to become general superintendent of the Montreal factory. Mr. L. D. W. Magie, of the Royal Electric Company, has been transferred to chief engineer at Peterborough, and Mr. Layfield has been promoted to works accountant at Peterborough. Mr. McDonagh, of the Royal Company, takes the position of factory accountant at Montreal. Mr. Edwards and Mr. Jenking, of the Royal Company, take important positions in the Toronto head office. Mr. Dean remains as manager of the Montreal branch office. Mr. Christie, of the Royal Company, takes the position of general storekeeper at the Montreal factory. Mr. Dobie and most of the principal members of the Royal factory staff remain with the Canadian General. Mr. H. G. Nicholls has been appointed assistant secretary of the company, and will also act as private secretary to the general manager.

Cable advices received on December 28th last announced the death of Mr. Frank P. Brothers, manager of the Cuba Company at Santa Clara, Cuba. Deceased was one of the best known railway men in Canada. He was born about fifty years ago in Quebec, and in early life was employed in the building of the Credit Valley Railway and the C. P. R. through the Rocky Mountains. He removed to Montreal in 1893 and became manager of construction on the street railway system in that city. Two years later he went to St. John, N. B., to superintend the construction of the electric street railway there. Returning to Montreal in 1896, he remained for two years, when he went to Kingston, Jamaica, and superintended the construction of a street railway system there. From Kingston he went to Demarara and superintended the building of a street car system in Georgetown. Last fall, at the request of Sir William Van Horne, he went to Cuba to look after the railway interests of the Cuba Company. Mr. Brothers enjoyed a national reputation as an able railway contractor. He leaves a wife and one son, who are now living in Toronto.

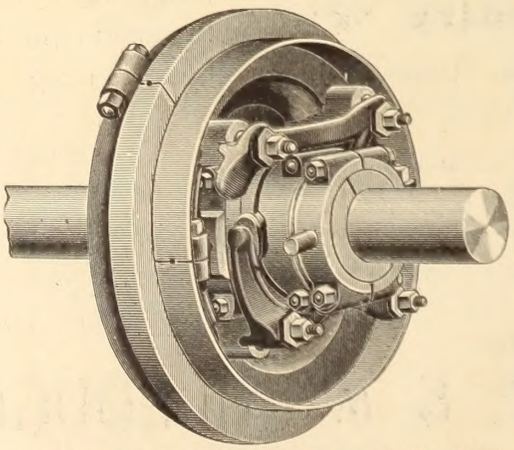
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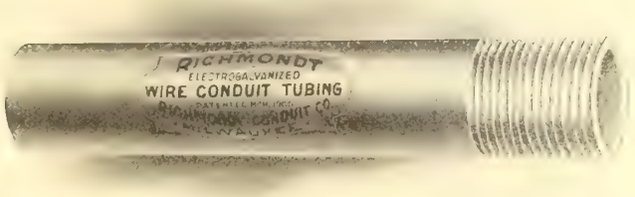
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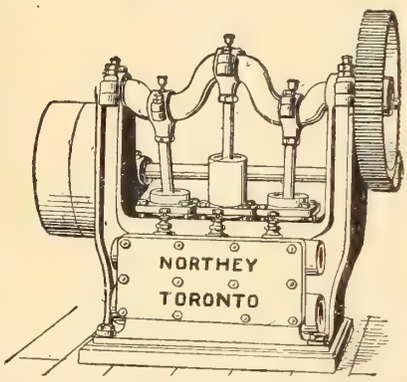
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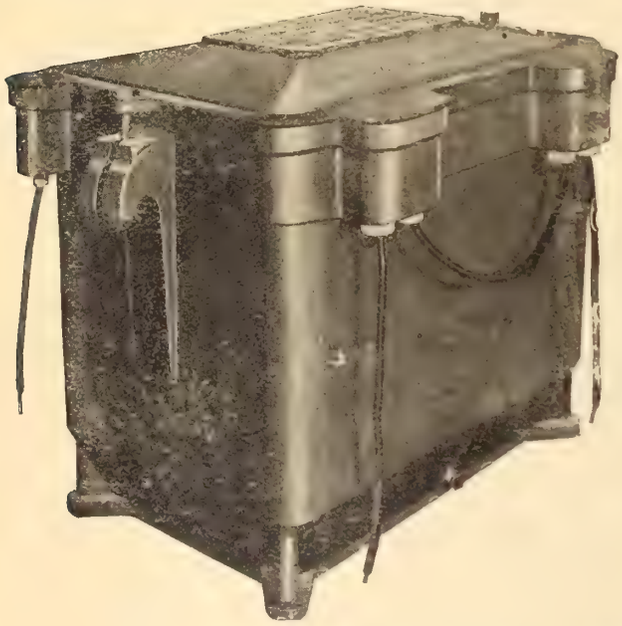


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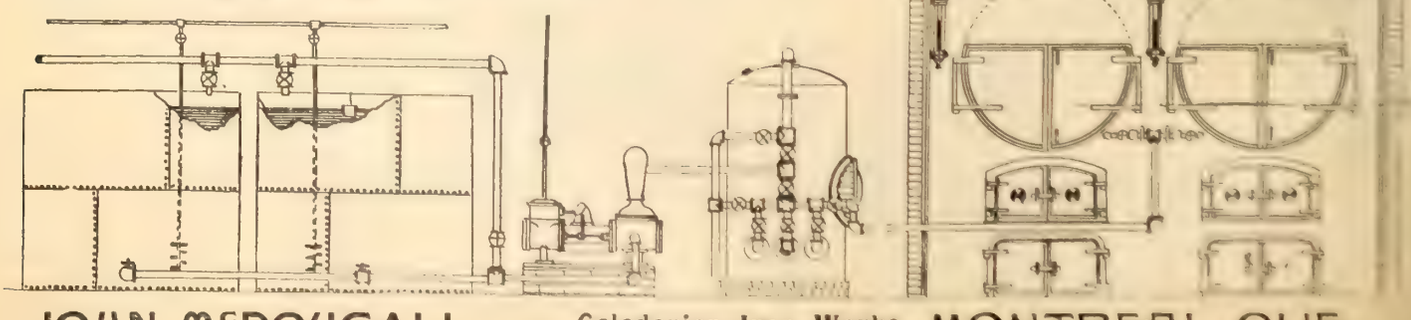
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ELECTRICAL NEWS

—AND

Engineering Journal

VOL. XI

1901.

THE C. H. MORTIMER PUBLISHING COMPANY OF TORONTO, LIMITED,

TORONTO, CANADA.

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CANADIAN

ELECTRICAL NEWS

AND

ENGINEERING JOURNAL.

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ELECTRICAL TRANSMISSION PLANT OF THE JACQUES CARTIER WATER POWER COMPANY, QUEBEC.

ONE of the most successful, interesting and up-to-date electrical transmission plants recently installed in Canada is that of the Jacques Cartier Water Power Company, supplying light and power in the city of Quebec—interesting on account of the engineering features of the plant itself, the historic associations and



FIG. 1.—MAIN DAM FROM RAILWAY BRIDGE.

quaint peculiarities of the city, and its predicted commercial importance in the near future.

The contractors for the whole work were the International Hydraulic Company, of New York, who recently turned over the plant to the Jacques Cartier Water Power Company.

The power house is situated on the Jacques Cartier river, at the rapids of St. Gabriel, 17 miles from the city of Quebec, the normal head being about 32 feet. As the river is here divided by a small island, two dams were necessary; both are substantially built of cribwork, the smaller being 142 feet in length, and the main dam, shown in Fig. 1, 158 feet. The dams raise the river sufficiently to give a level surface for six miles up, thus giving considerable power storage, if it should ever be necessary, and at the same time entirely obviating any trouble from frazil. At one end of the main dam is built a heavy masonry bulkhead, from which the two feed pipes, 13 feet in diameter, lead to the power house, 270 feet below.

The power house, shown in Fig. 2, is of brick, 56x86 feet, and is situated at such an elevation that, at ordinary conditions of the river levels, the turbines are driven under a pressure due to about 17 feet of head above, with a draft-tube vacuum due to about 15 feet of fall below.

Each of the two generators is direct connected to two 54 inch McCormick turbines, manufactured by the S. Morgan Smith Company. These wheels under 30 feet head are capable of delivering 1,710 h. p. at full gate. The water-wheel governors on the large turbines are of the Lombard type. The 30 inch feed pipes for the exciter turbines are fed inside the power house from the main pipes, being arranged with four valves, so that either exciter turbine can be fed from either of the main pipes. A view of the wheel room is shown in Fig. 4. In the spring of this year, two large stand-pipes are to be erected close to the power house, one on each side of the pipe-line, to overcome the inertia effect in the long feed pipes; this effect is so marked that it is not practicable or safe to operate the governors automatically under present conditions, the governing in the meantime being done manually, which, although troublesome, is very satisfactory, the regulation being inside of 1 per cent. each way under varying load.

The electrical equipment of the power house is of Westinghouse manufacture throughout. The two generators are of the three-phase, revolving armature type, of 750 k. w. capacity (guaranteed for 5 hours at 25 per cent. overload), wound for 2,000 volts, 7,200 alternations per minute, at 150 revolutions per minute. The exciters are 37.5 k. w., 125 volt four-pole machines, each direct connected to a single 18 inch turbine, running at 350 r. p. m., and regulated by a small Walsh governor.

The switchboard (Fig. 6) is of five panels, one exciter panel, two generator panels, and two line panels. It is



FIG. 2. POWER HOUSE AND DAM FROM BELOW.

similar to the standard Westinghouse board, but with some additions and changes. Besides ammeters in every phase of each generator and line, there are two Niagara type indicating wattmeters on each generator panel, and a Westinghouse polyphase integrating wattmeter on each line panel. It is furnished with duplicate sets of bus-bars and double throw switches on generators, lines and exciters.

There are two sets of step-up transformers, each of three 250 k. w. units, of the Westinghouse self-cooling, oil-insulated type, raising the voltage from 2,000 to

20,000 volts. These are delta connected on primary and secondary, so that in case of one transformer becoming disabled, the service can be continued on the remaining two units of the same set.

Through the centre of the power house runs a brick



Fig. 3.—Power House from Bulk Head.

wall set on a 5 inch masonry foundation wall, beginning below the level of the bottom of the draft-tubes, and running up to just below the floor level, each side of this foundation wall being filled in with rubble masonry up to the concrete under the cement floors. On one side of this brick wall is the dynamo room, containing the generators, exciters, switchboard and water-wheel governors; on the other side on the ground floor is the wheel-room, on the first floor the space is divided into eight rooms, in the largest of which are the step-up transformers referred to above. In the attic are the 20,000 volt combined fuse and circuit breakers and a set of Wurt's lightning arresters, on marble panels, designed also for 20,000 volts.

A unique feature of the power house is that a part of it, the remaining seven rooms referred to above, is used as living quarters for the power house staff, one man being employed as cook. There are four double bedrooms, a dining room, kitchen and bath-room. The arrangement is found to be a comfortable and convenient one. A separate building, also containing a private



Fig. 4.—Wheel Room, Showing Exciter Wheel Cases and Cross-Pipe.

living room, is fitted up as a store-room and work shop, another building near by being a blacksmith shop.

The transmission pole line is, generally speaking, of 35 foot poles, but where irregularities in the ground occur, or where the line passes near dwellings, the poles are much higher than this; in one case where the line passes along a cemetery bordered by high trees, spliced poles are used, 80 to 85 feet high.

The transmission line is composed of two sets, each of three No. 4 B. & S. hard drawn copper wires, each set being transposed five times. The telephone line is transposed every second pole; in neither case is any trouble from induction experienced.

Just outside the city limits is situated the transformer sub-station (Fig. 8), a brick building with cement floor, containing high potential circuit breakers and Wurts lightning arresters of the same type as at the power house, and two sets of step-down transformers; each set consists of two 375 k. w. units with Scott connection for transforming the 20,000 volt three-phase current to two-phase current at 2,000 volts. The trunk line running from this point to the distributing switchboard, about one mile, is on 60 foot poles, carrying two four-wire sets of No. 00 .B & S. weather-proof wire.

The distributing switchboard is temporarily set up inside the walls of the old fort, in a substantial, though small, stone building, which was originally a powder magazine. This arrangement is made pending the

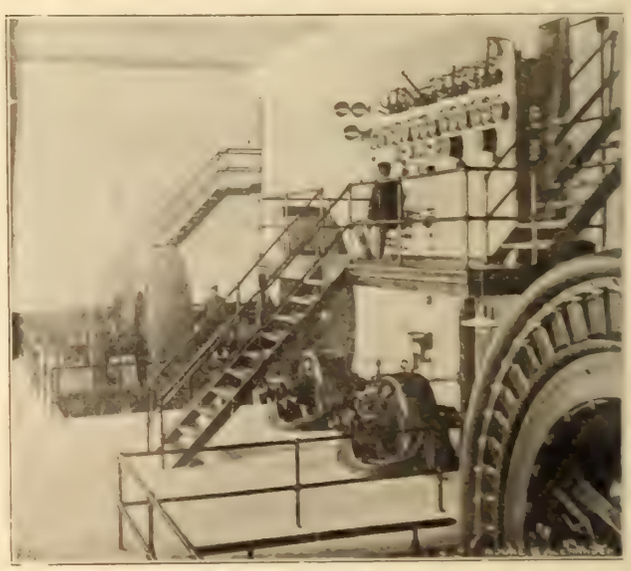


Fig. 5.—Dynamo Room.

completion of a spacious building which the company are about to build, combining the general offices and store-rooms with the distributing station. The building will be situated at about the centre of the city, on one of its most important thoroughfares. The switchboard consists of five panels, two for the two trunk lines, two distributing panels, and one regulating panel. By double throw switches on the line panels the current is switched on either set of distributing bus-bars, on either of which by similar double throw switches on the circuits panels, any city line, of which there are at present eight, may be thrown. On these circuit panels are plugs with flexible couplings, two sets to each circuit, so that in case of a throw over to the other bus-bars no interruption of light need occur.

The regulating panel is equipped with Stillwell regulators boosting 4 per cent. each way. On this panel is also a voltmeter and multipoint switch, to which runs a complete system of pressure wires from two points on each of the main banks of transformers in the city distribution. By the voltage on these pressure wires the regulators are worked, in some cases also enabling the switchboard attendant to detect a blown transformer fuse before being notified by customers.

To correct the power house voltage so as to give

the required pressure at sub-station, two other voltmeters on the regulating panel are used, one on each phase of the lighting bus-bars, the mean of their readings being taken. To communicate with the power house a system of signalling is used, which deserves special notice on account of its novelty, convenience and effectiveness. Choke-coils are connected across the telephone line both at power house and distributing station, having an impedence so high that the ordinary use of the telephone is not affected. The middle points of these coils are grounded, and a relay and key inserted at both ends, ennabling signals to be made even if the telephone line becomes short-circuited, or if one wire be broken. The regular practice is regulation within ½ per cent. each way.

The city is divided into eight districts, fed by separate sets of primaries; in each district there is one or more banks of transformers, feeding a three-wire secondary system, 108 volts on each side. The three-wire principle is carried so far that where many customers are supplied from the same loop, three wires are run to the bracket where services diverge, using 216 volts, thereby giving much better regulation with same amount of



Fig. 6.—Temporary Distributing Switch-Board.

copper. Some outlying districts, of which several have not before had electric light, i. e., St. Louis Road, St. Foye Road, Sillery, are now reached; in these districts customers are supplied mainly from independent transformers. An entirely separate city system is used for the power service, current being supplied at 500 volts. For the purpose of this part of service, the city is divided into two districts respectively, east and west of the distributing station. The indications at present are that this will soon be a very important part of the system.

It will be noticed that the entire plant from power house to distributing station is in duplicate, so that in case of a breakdown in any part, the duplicate part may be used to continue the service.

The transformers, meters and lamps used were manufactured expressly for the company, and on their specifications. Pittsburgh transformers, Westinghouse and Diamond meters and Imperial lamps are the types employed at present.

The transformers have a special winding, the two secondary coils each giving 108 volts, so that a single transformer may feed a three-wire set. They have proved peculiarly free frym lightning trouble, as in spite of the heavy storms of the past summer, not one breakdown has occurred. Before being put into service, each transformer is given an eight hour run at full load, iron and copper losses are measured, and ratio tested with a standard transformer. From these tests the



Fig. 7.—View of Transmission Line.

percentage regulation up to full load is obtained. A complete record is kept of every transformer; besides the manufacturer's number, each is given a local number, its position is noted, with number of lamps fed, either from this transformer singly or from the bank of which it forms a part, also the number of lamps on each side of the three-wire system. The record is referred to before connecting up any new installation, so as to keep, as nearly as possible, a balanced load on each transformer, and to avoid overloading. Between each two transformers on the two outside wires of the secondary mains, junction boxes are inserted, thus preventing the crippling of the whole bank should the fuse on one of the transformers blow.

Every meter is tested at various loads, and a complete record is kept on file.

Five lamps from each barrel of every shipment are put on a testing rack and tested every 48 hours for candle power and wattage, and are also run for life. Curves are drawn showing the decrease in candle power and the increase in wattage, and a mean efficiency curve is also drawn, specially noting at what age the lamp crossed the 10 per cent. and 20 per cent. depreciation lines. These curves are drawn for each set of

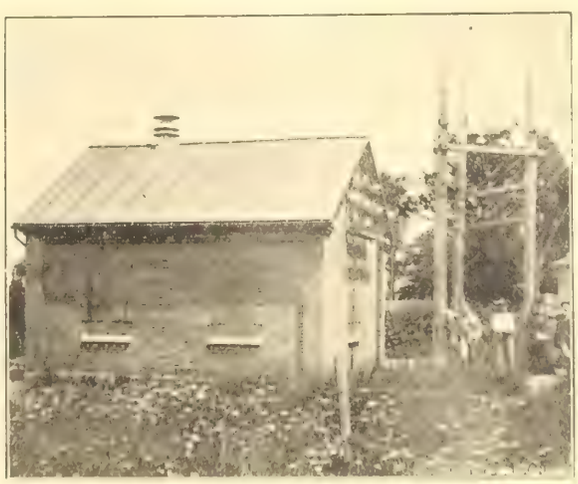


Fig. 8.—Step-Down Transformer House.

lamps on test, and the photometer work is done with laboratory precision. The lamps are supplied free on first installations, and for meter customers free renewals. To flat rate customers lamps are sold below cost of any on the market, so as to secure proper service. A

3.1 watt lamp is used on meter installations, and a 3.5 on flat rates. Complaint cards are sent to subscribers, which they may fill in and return in case of any dissatisfaction, and whenever necessary a Bristol voltmeter in portable form is set up on the customer's premises, so that the voltage may be checked up for a few days.

The company is operating under a very keen opposition, but, on account of its liberal policy, coupled with its earnest efforts to serve and oblige its customers,



FIG. 9.—DISTRIBUTING STATION.

and the fact that it was the cause of reducing rates about 40 per cent., it has met with liberal support from the citizens. All the poles were specially selected, and the company avoided the principal thoroughfares as much as was practicable. These points alone helped to win the esteem of the public.

The management of the company is in the hands of Mr. Edward Slade, while Mr. G. Hartman is superintendent.

COMPLIMENTARY DINNER TO PROF. GALBRAITH.

THE assembling of nearly three hundred students and graduates of the School of Practical Science at the complimentary banquet tendered to the worthy Principal, Prof. Galbraith, on December 21st, was a high tribute to that gentleman's personal popularity and worth, as well as to the value of the services which he has rendered to the cause of scientific education in Ontario. Graduates were present from almost every part of the Dominion and from across the line. The arrangements for the dinner were most complete, reflecting much credit upon the energy and taste of the committee.

McConkey's handsome new ball-room was utilized for the occasion. On the walls were 21 shields bearing the names of the graduates of each year since the opening of the school.

Mr. James McDougall, engineer for the County of York, presided, having on his right the Minister of Education and on his left the guest of the evening, besides many other guests of prominence. In the balcony were a number of ladies, including Principal Galbraith's aged mother and Mrs. Galbraith.

There was much handshaking and jollity among the "old boys," who in many cases had not met for years, while the present day students caused many a laugh by the clever bon mots with which they punctuated the remarks of the various speakers.

In expressing his acknowledgment and appreciation of the honor conferred upon him, Prof. Galbraith took occasion to refer to the subject of engineering education, based upon his experience during the last twenty-one years as Principal of the School of Practical Science, and his knowledge of the success of its graduates. He pointed out that while it was plainly impossible within the short space of three or four years to turn out an engineer, architect or chemist fit for the full responsibilities of his profession, a scientific school could furnish its students with advantages which it was worth time and money to acquire. Perhaps the chief object of such a school was to train its graduates to read and appropriate the facts supplied through engineering literature, and to acquire skill of hand, eye and ear by work in the laboratory, drafting room and field. One of the greatest advantages of a ocurse of study in a scientific school was that the mind of the student is almost unconsciously trained in the classification of facts. He cannot attend the various classes for three or four years without knowing to what departments or subdepartments of science the facts of observation are to be referred, and even if he has forgotten how to apply the sciences he knows at least where and how to get the information he requires without loss of time. His course in the school has supplied him with a great catalog of knowledge.

The Principal, in bringing his remarks to a close, made the important announcement that the Senate of Toronto University had passed a statute which provides that the School of Practical Science, its teaching staff, examiners and students, together with the examiners for the degrees in applied science and engineering, shall ex officio constitute the Faculty of Applied Science of the University of Toronto. By this statute the powers of the Senate with reference to the degrees, and those of the school with reference to the work of instruction,



FIG. 10.—VIEW OF CITY DISTRIBUTION.

as also the statute respecting affiliation, remain unaltered. The result is that the University gains, without expense, a fully equipped Faculty of Applied Science, and in this respect puts itself on an equality with the other great universities of the continent; while, on the other hand, the School of Science gains public recognition of the fact that its work is of equal rank and dignity with that of the ancient faculties of arts, medicine and law.

The proceedings terminated with the presentation to Prof. Galbraith of a handsome gold watch by the graduates and undergraduates of the school.

MONTREAL

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MONTREAL, JAN. 9TH, 1901.

It seems rather a pity that Canadians do not appear to be satisfactory to Canadian institutions. The Canadian Pacific Railway Company, who certainly owe their very existence to Canadians as a whole, have seen fit to give the contract for the electric light wiring required in the new extension being built to Windsor depot, to Edwin C. Lewis & Co., a United States firm of wiring contractors. This was followed up in a more flagrant manner by the Grand Trunk Railway Company giving their contract for similar work to the Western Electric Company, again United States. This case is termed more flagrant because when the city of Montreal ceded the land on McGill street for the new office building (the one referred to), it was distinctly understood that local contractors were to be given the work ; certainly the city of Montreal had no intention of figuring as philanthropists for the benefit of wealthy American firms.

Quite a serious fire occurred in this city recently, due, it is claimed, to high tension current coming in on the interior wiring at the residence of Mr. Hugh Paton on Sherbrooke street. The wiring was done some seven years ago, and for a job of that date is not at all bad. Red core "habirshaw" wire was in use, but unfortunately no main switch. The "fixtures" had been furnished with the old "fibre sheet" insulating joints, and one fixture had been overlooked evidently, as it had none at all. The point at issue, however, is this, why should the underwriters have their inspectors call on small retail stores and other petty risks, and yet not visit private dwellings as well? Surely one is as liable to "electric fires" as the other, and equally worthy of inspection. In this very case no objection would probably have been raised by Mr. Paton as to "expense" had he been requested to bring his installation up to standard ; but it is more than possible the first thing he heard of any "regulations" was after being burned out.

Decorative electric illuminations were few and far between in outdoor Montreal during the late holiday season. What there were consisted of conventional lines of alternated red, white and blue lamps, which cannot be called decorative, and in fact since such have appeared ever since jubilee year, they begin to pall on one. Where lines of lights are used to show the architecture by picking out the outlines of a building they are right enough, otherwise the effect would certainly be more appreciative if worked into heraldic shields, national flags, etc. As this, however, probably costs a little more, it may explain the reason why so many of our shop-keepers decorate electrically, when they do it at all, by hetergeneous strips of everlasting red, white and blue lamps. We understand that some good Xmas tree work was done in some private families when miniature lamps of various colors were interspersed amongst the branches and connected up in series-multiple with the illuminating circuits of the house.

WHAT IS A "HORSE POWER" (H. P.)—WHAT ITS VALUE OR COST?

BY CHAS BAILLAIRGE.

This, in mechanical parlance, is said to be equal to 33,000 lbs. elevated to the height of one foot in one minute of time.

I am led to the explanation of this from seeing that at a recent meeting of stockholders of the Chaudiere Electric Light Co., where an offer was being discussed of so many thousand dollars for so many or so much horse power, no one seemed to have a very clear idea of what a horse power is or of what its value is in dollars.

As a matter for comparison, I explained, in discussing the value of the proposition, that if a horse costs $100.00, at which price an able-bodied animal may be purchased, its yearly value at 5% interest on cost is $5.00. "Now," said I, "a horse is like a loan—a loan is to become extinct, say in 30 or 40 years, and a sinking fund has to be provided of say 2% to pay it off. The horse also will become extinct or cease to be of much use after 10 years, and thus to cover cost of purchase $10.00 per annum has to be allowed wherewith, at the expiration of that time, to purchase another. $10.00 and $5.00 are $15.00. Now, you have to feed this horse, and he will eat in a twelve-month 500 bundles of hay, which, at $5.00, comes to another $25.00. Add again say 26 bushels of oats,a bushel a week or a gallon a day, at 50 cents—$12.50 more—together $62.50 as almost a minimum."

Man, by harnessing the powers of nature, as evidenced in waterfalls, by the discovery and application of steam, compressed air, electricity, etc., has given us a substitute for the actual or living horse, and one easier to handle and more economical; but even so, this mechanical horse power costs something, since there are to be allowed for the interest on cost of damming rivers to get the head of water necessary to utilize this element, the interest on cost of machinery and engines.

There is the yearly cost of the horse, for purchase. Dams and machinery wear and are subject to accidents and have to be repaired, and there is the yearly cost for maintenance. The works can last but for a limited number of years, and this is where the sinking fund comes in to wipe out the cost and provide for renewals, and all this, with cost of management, amounts to something. Therefore a mechanical horse power, like the living one, must cost if not $50.00 or $60.00 a year, a goodly portion of this sum. If it only costs $15.00, there is already a tremendous saving, and I have seen it sold for $10.00, representing, say, allowing for leakage and induction, the power to run one arc light of 1,200 to 2,000 c. p., or 5 or more incandescent or series lights of 32 c. p.

Now, the offer made to the Chaudiere company for the balance of the horse power of the falls, after deducting 2,500 h.p. for the electric lighting of St. Romauld, Levis, etc., was less than $2.00 per h.p., and I have never as yet seen or heard of its being valued or sold at less than $5.00. So upon this showing it was decided not to sell, but instead of that to erect pulp works to utilize the surplus power and thus bring in likely as much as $10.00 over 15% or more on the investment, and shares are now rapidly being taken in Quebec to this effect.

What I have just said refers only to the cost of horse power. But what is a horse power? As stated at the head of this article, it is, for purposes of calculation, defined to be 33,000 lbs. elevated to the height of one foot in one minute of time. The object of this mode of stating the proposition is that one of the terms is unity, and that all calculations involving comparison of quantities or the use of what is called "the rule of three" (if one term is 1 (or unity) and as multiplication or division by 1 does not alter the quantity, the arithmetical labour of computation is reduced to a mere operation in simple arithmetic.

But, again, why this mode of stating the h.p? Could not some more simple mode have have been arrived at, something more suggestive to the mind? Yes, and here it is ; and a friend of mine, a litterateur, but which does not debar him from an attempt at understanding what is a horse power, wrote me on the appearance of my last work, "Divers ou les Enseignements de la Vie," that never before my explanation of the thing had he been able to understand the meaning of a horse power, thus set forth arithmetically. Of course one will say 33,000 lbs. is not a weight which can be handled by a horse, nor can there occur in practice such a thing as a horse having to elevate that weight to a height of one foot. Well, let us decompose these 33,000 lbs. elevated to a height of one foot into 330 lbs. elevated to a height of 100 feet. This will be made plain to everyone. Hitch your horse to a rope and pulley with a weight of 330 lbs. of brick, mortar, stone, wood, or iron, etc., in the same way as you see them hoisting flour or grain in bags or barrels to the upper stories of a store. The horse will walk 33 paces of 3 feet in less than half a minute of time, and will return again in less than half a minute to be hitched on to another load, and in his horizontal reach of 33 paces or 99—say 100 feet—he will have raised his load of 330 lbs. to an equal height of 100 feet, and 100 lbs. raised 100 feet high is of course the same thing as 100 times as much (or 33,000 lbs.) raised to a height 100 times less (or 1 foot). There, then, you have the performance accomplished, and as the horse can go on doing this for a whole day, say of 8 to 10 hours, the meaning and truth of the assertion is made evident and becomes admissable that a h.p. may be and is equal to its mechanically expressed equivalent of 33,000 lbs. elevated to a height of one foot in one minute of time.

Finally, how was this figure for a h.p. arrived at? The only way in which it naturally should be, that is, by taking a horse and keeping him at this work of hauling up a given weight to a known height, during a day of 8 or 10 hours, and for a week or more, to study his powers of endurance, and by doing so with several horses to get a fair average, and then multiplying the total pounds raised during the 10 hours by the total feet to get what are called foot-pounds, and then dividing the result by the number of minutes in the ten hours (600), thus arriving at 330 lbs., raised 100 feet in one minute, or 33 lbs. raised 1,000 feet in one minute, or 3,300 lbs. raised 10 feet in one minute, or 33,000 lbs. raised one foot = 33,000 foot-pounds.

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The ELECTRICAL NEWS will be mailed to subscribers in the Dominion, or the United States, post free, for $1.00 per annum, 50 cents for six months. The price of subscription should be remitted by currency, registered letter, or postal order payable to C. H. Mortimer. Please do not send cheques on local banks unless 25 cents is added for cost of discount. Money sent in unregistered letters will be at senders' risk. Subscriptions from foreign countries embraced in the General Postal Union $1.50 per annum. Subscriptions are payable in advance. The paper will be discontinued at expiration of term paid for if so stipulated by the subscriber, but where no such understanding exists, will be continued until instructions to discontinue are received and all arrearages paid.

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EDITOR'S ANNOUNCEMENTS.

Correspondence is invited upon all topics legitimately coming within the scope of this journal

The "Canadian Electrical News" has been appointed the official paper of the Canadian Electrical Association.

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A Hint to Central Station Owners.

"Judicially blind to the fact that an old power house, with board floors well soaked with the drippings of oil for many years, was a veritable tinder box, the directors of the Brooklyn, New York, Rapid Transit Company neglected to insure one of these buildings. After last week's burning the company's guardians now wish they had thought otherwise. A loss of one hundred and seventy-five thousand dollars is a somewhat costly experience."—Fire and Water. How many stations in Canada have oil soaked board floors? How many are properly equipped with fire and lightning protecting appliances? How many are adequately insured?

Question Department.

A gratifying interest is being shown in our Question and Answer Department. It is hoped that it may continue. Electricians, engineers and others who, in their daily experience, meet with extraordinary experiences or peculiar difficulties in connection with the operation of their plant, are asked to write to this department, giving a full explanation of the circumstances so as to make an intelligent and helpful reply possible. In such cases we shall endeavor, as far as possible, to give a satisfactory solution of the problem, and in this way to make the department of benefit to subscribers. Each reader should make it a point to submit a question occasionally, and also to give his opinion on the questions propounded.

Electrical Matters in 1900.

THE developments in the electrical field during 1900 were in line with the rapid progress which that industry has made during late years. Perhaps the greatest advancement was in the application of principles already known rather than in the direction of new discoveries. There was a more general employment of alternating current apparatus and enclosed arc lamps. Improvements were made to the Nernst lamp, but they were not of a character to place that lamp in the market as a competitor to the types already in use. Considerable advancement was made in the direction of transmitting messages without wires. In Europe there were some practical applications of wireless telegraphy. The Postal and Telegraph Department of Germany have adopted such a system based on the Braun theory. Towards the close of the year Signor Marconi was reported to be arranging to erect wireless telegraph stations along the route from Great Britain to Australia, to enable voyagers to send and receive messages throughout the trip. Several experiments of telephoning without wires have been tried in the United States, and are announced to have produced satisfactory results. In the direction of long distance transmission of power the year was a notable one in the United States, a successful test having been made in driving a motor situated 153 miles from the source of power. The automobile industry made remarkable progress during the year, the investigations along this line showing that there is a special field for the electrically porpelled vehicle. In Canada considerable progress was made in electrical matters. Two quite important water power projects were carried to completion, namely, those of the Jacques Cartier Electric Light Company and the Canadian Electric Light Company at Quebec. There was experienced during the year an increased demand for electrical goods and particularly for motors, a number of our large manufacturing establishments having adopted electrical power where steam was formerly employed. There was a noticeable growth in the electric lighting industry, this form of lighting being now in use in small villages and towns where gas and oil was until recently employed. The progress in electric railway construction was likewise of a satisfactory character, and the indications at the present time are that the construction of many miles of radial electric railway will be undertaken in Canada in the near future.

An event of no little interest to the electrical fraternity marked the closing days of the year. It was the absorption by the Canadian General Electric Company of the manufacturing department of the Royal Electric Company. These two companies have furnished the electrical apparatus for the most important power transmission systems in Canada, those of the Cataract Power Company at Hamilton, Chambly Manufacturing Company and Lachine Rapids Hydraulic & Land Com-

pany near Montreal, and the West Kootenay Power & Light Company at Rossland, B. C. So far as Canadian manufacturers are concerned, the Canadian General Electric Company, by their acquisition of the Royal Company's works, would seem at the present time to have a monopoly of the manufacture in Canada of apparatus specially suited for the long-distance transmission of power. In addition to the wide range of electrical apparatus and supplies which they have heretofore supplied to the trade, they are now in a position to furnish the celebrated Stanley inductor machines. The taking over of this plant will no doubt prove a great advantage to the Canadian General. It is the intention to continue the operation of the Montreal factory.

DEVELOPMENT OF WATER POWERS.

At a meeting of the Engineers' Club of Toronto, held on December 19th last, the development of water powers formed a subject of discussion. It was introduced by Mr. A. B. Lambe, Jr., of the Canadian General Electric Company, who outlined the general principles on which power is obtained from water falls. Although purposely elementary in character, his remarks were of such a nature as to give those present an intelligent conception of the subject, and to create considerable discussion.

At the outset Mr. Lambe stated that the initial cost of apparatus for producing a given amount of power was generally greater with water than with steam, but with the former the amount of depreciation was smaller, and fewer and less skilled attendants were required. In developing a power the four vital points to be considered were flow, head, cost of development and market for power. To each of these he referred briefly. In respect to the flow he said that many plants had been found practically useless because the estimated quantity of power available had been based on the maximum flow at the heaviest season, also that the probability of the flow being greater in one year than in another had been overlooked. The usual method of measuring the flow was the miner's inch, which represents 9 gallons per minute, the head not entering into the calculation.

The head of the water available was a most important consideration, as the power, and therefore the value of a given flow, varied directly with the head. For a high head less costly machinery could be employed, because it would be lighter and revolve at a higher speed. It was possible to deliver for use 60 to 70 per cent. of the power in the water.

In Mr. Lambe's opinion engineers frequently overlook the fact that the commercial side of any enterprise is the most important one. The cost of developing water power varies from $30 to $1,000 per horse power. In California a plant designed for 4,000 h.p. was found to be capable of delivering but 300 h.p. in July and August, the months of low water, and, of course, was a failure financially. The financial success of a water power development costing $200 per developed horse power is very problematical; the average cost for plants possessing no unusual characteristics is from $40 to $100 per horse power.

The market for power was a factor requiring careful consideration. Mr. Lambe did not think that new power plants could expect to find a large market among manufacturers already established and using other sources of power, as they are likely to be opposed to displacing their existing apparatus with other and more or less expensive machinery, but must look for their customers among manufacturers likely to be attracted to the place by cheaper power.

The question of apparatus was next taken up. Water motors, he said, divide themselves roughly into the following classes:—1st, bucket engines, rams and pressure engines; 2nd, vertical wheels; 3rd, turbines. The water pressure engines in use to-day are employed mostly for cranes, hoists, dock-gates and capstans, finding their highest development in England and the continent. The vertical wheel is divided into the under-shot, over-shot and breast-wheel; while turbines divide into pressure and impulse wheels. The greater part of the wheels on the market to-day are manufactured in the United States, Italy and Switzerland. Pressure wheels are operated successfully under heads as low as 3 feet, and jet wheels under heads as high as 2,100 feet.

The ordinary plant, the speaker explained, divides itself into reservoir, head race, wheel proper, and tail-race. The question of storing the head water was one which had received much attention. In certain localities some plants are laid out so as to take advantage of the snow when melting in the spring. In California wonderful examples in hydraulic work are to be found, in some instances the water being carried twenty-five miles, through tunnels in the solid rock, through wooden ditches round the mountain side, crossing valleys by conduits suspended high in air, or by siphons winding down one side and up the other, on through wooden conduits buried perhaps 20 feet under the surface, finally plunging almost vertically down the hill side into the wheels through a steel conduit varying from ⅛ inch steel at the top to ½ inch thick at the bottom. Incidentally, Mr. Lambe mentioned that a stream the size of a lead pencil under a head of 2,100 feet would, with a wheel weighing sixty-two pounds, give about 20 h. p.

Brief reference was made to the various types of wheel cases in use and to the construction of the tail-race. Then the question of efficiency was taken up. Modern wheels, said Mr. Lambe, would give an efficiency of from 70 to 75 per cent., although some manufacturers claim even as high as 93 per cent.

The governing of water wheels was one of the most perplexing questions. In driving electrical machinery it was necessary to get the speed regulation extremely close, a variation not exceeding 2 or 3 per cent. freqnently being guaranteed. The most common method of governing was to vary the gate opening. In some plants the gates are so geared that they cannot be closed quickly, and the flow is thus permitted to stop gradually. Relief valves was another method of governing, while still another was to place a by-pass between the head water of the wheel and the draft tube which is controlled by the governor. Mr. Lambe concluded by giving a brief description of the different governors in use.

Mr. E. H. Keating stated that he was much interested in Mr. Lambe's remarks, in-so-far as they related to the transmission of power, as a company with which he was connected had for some time been looking into that question. Opinions seemed to differ very greatly as to the price at which power generated from water could be delivered at point of utilization, and there was much conflicting evidence as to losses, etc. With steam power the exact cost could be computed. He also brought up the subject of interruptions to transmission lines.

Mr. W. T. Jennings, C.E., said that the first condition to be considered in the development of a water power was the market. It was also necessary to estimate on the minimum flow of water unless there were means of storage. The cost of power, he said, depended on local circumstances, and would be much higher with some plants than others. Take Niagara, for instance, where there is a high head, the cost of the flume was over $2,000,000. As showing the advancement which had been made, he said that eight years ago it was not considered that electric power could be transmitted from Niagara Falls to Queenston in competition with steam. Mr. Jennings was associated with the construction of the Metropolitan electric railway, North Toronto, and stated that after starting interruptions occurred daily for some time. It was found that these were caused by straws being blown onto the wires and by branches of trees falling upon them. Mr. James McDougall also spoke along the same line.

In answer to Mr. Keating Mr. Lambe said that where interruptions occurred in a transmission line it was usually the result of poor construction and incompetent operation, and could be avoided by proper construction and due attention thereafter. The breaking of white porcelain insulators by boys had been a source of considerable trouble, to remedy which some manufacturers were now putting on their insulators an outside brown coloring coat.

Mr. Chipman said that there were many inland steamers where the development of water power was contemplated, but one thing which was lacking was a knowledge of the drainage area. He urged that the Government should authorize a proper topographical survey.

Mr. T. R. Rosebrugh spoke on the subjects of governing and line losses. At voltages of 40,000, he said, there would be discharges and consequently a certain loss even if no power were being consumed. It would take a considerable horse power to maintain the line voltage even if no power were being taken from the line.

Mr. H. F. Duck thought that the difficulty in connection with some water power developments had been that superintending engineers of ability had not been employed.

A unanimous vote of thanks was tendered to Mr. Lambe for introducing the subject.

POWER PLANT AT MONTMORENCY FALLS, QUEBEC.

By George W. Bowie, H.E.

The power and generating station of the Quebec Railway, Light & Power Company, situated at Montmorency Falls, seven miles east of the ancient city of Quebec, is probably one of the most interesting, instructive and modernized plants on the continent of America. Its electrical and hydraulic equipment, consisting of the dam, pipe line, power house, turbines and electrical machiney, in its present complete and finished whole, is a creditable example of energy, mental and physical, to overcome natural obstacles in construction, and adverse conditions, which is the delight of the present day engineers to combat and bring to a successful issue.

In these days of herculean enterprises it was not to be expected that the energy of the picturesque Montmorency Falls would be exempt from being made subservient to man's use. So that an account of the electrical hydraulic engineering work which has elevated the antiquated city of Quebec to a first place amongst the cities of Canada and the United States for electric car service and lighting, will not come amiss. What makes an account of this plant doubly interesting is the trouble experienced in designing a turbine suited to a high head of water free from noise in operation and complete destruction in a limited time from perforation of all metal exposed to the impingement of the water on the surfaces receiving the full force at a high pressure. It was only after a lapse of considerable time and constant experiment that the present turbines (the first of their kind installed) were designed by the water wheel manufacturers, who have now been able to devise an "Ideal" turbine suited to the requirements of high head water power and free from all the objectionable features that have hitherto existed in wheels running under these conditions.

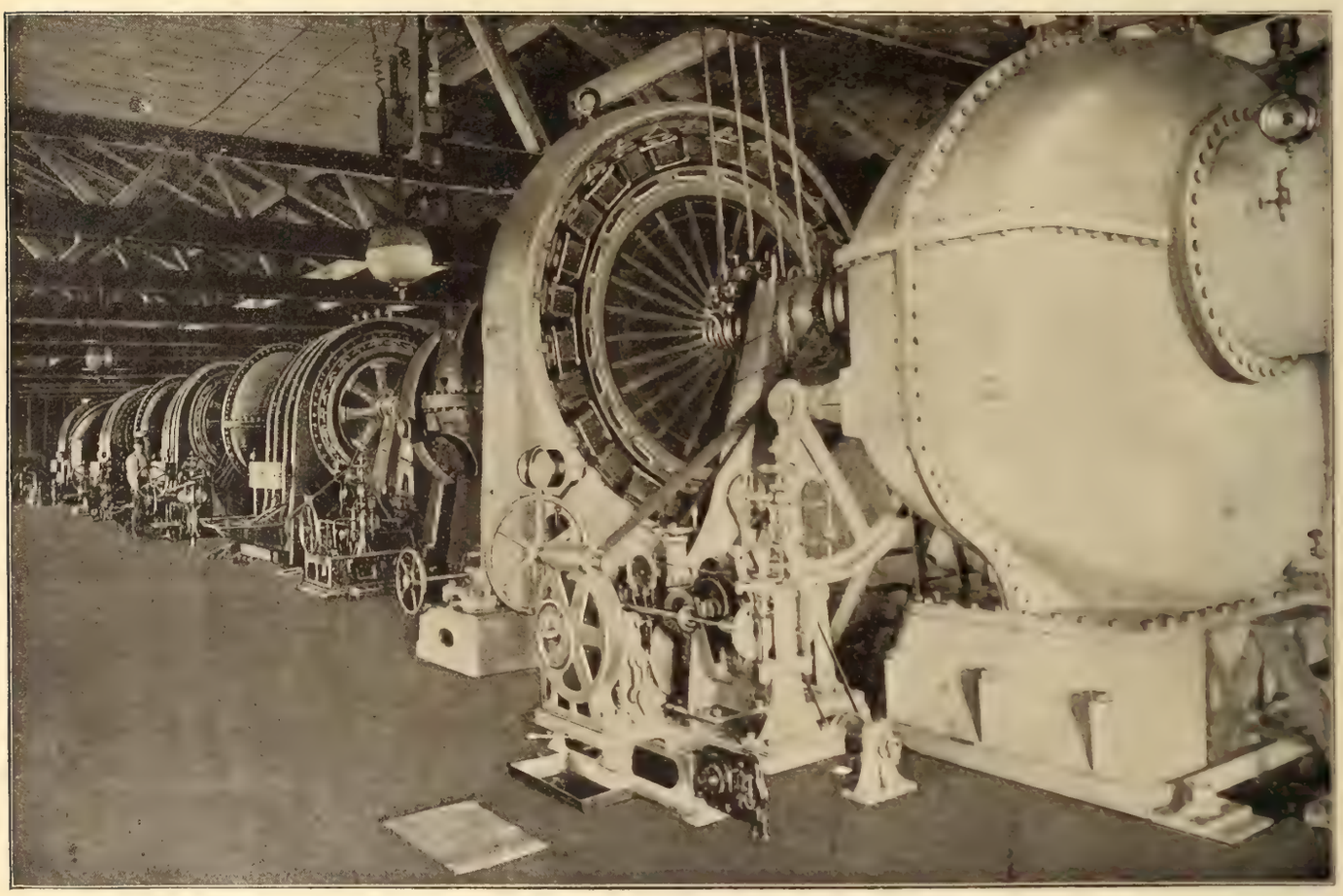


Fig. 1. View in the Power House, Showing Double-Current Generator and its Turbine in the Foreground.

SOURCE OF WATER SUPPLY AND DAM.

The Montmorency river has its rise and origin at Snow Lake, about 75 miles from the falls and power station, and drains a considerable area of almost virgin territory, providing an ample supply of water at the dryest season of the year sufficient to develop 10,000 horse power. The dam is built on the verge of the abyss of the famous, historical and well known Montmorency Falls, whose water has a sheer drop of 264 feet into the St. Lawrence river. As useful energy, 200 feet of this fall is utilized by the Quebec Railway, Light & Power Company for commercial purposes in generating electricity. The shape of the dam is rhomboid, the right angled side (facing up-stream) is built of concrete, and is undoubtedly a model of strength, as the conditions made it necessary that it should withstand sudden rises and fast flowing freshets in the river, also the great accumulations of ice in the winter season, which is somewhat prolonged in this latitude. The length of the dam is 265 feet (between shore piers), height 18 feet, thickness at bottom 22 feet, and at top 8 feet.

The gate house dam and abutments contain 4,616 cubic yards of concrete. The mixture of the concrete for interior of dam is 1 of Portland cement, 3 of sand, and 5 of broken stone; for facing, 1 of cement, 2 of sand, and 3 of stone, 12 inches deep from its respective surfaces. A waste water way was also provided to divert the surplus water not used in the feeder pipe while dam was under construction.

At no time during the progress of the work on the dam and gate-house was the generating of electricity under the old system interfered with, the company's engineer and superintendent having arranged, with great forethought, temporary feeder pipes and connections to meet all emergencies arising from the change from the old plan to the new. Another matter which demanded important consideration for uninterrupted winter service was adequate protection against frazil or anchor ice, which is abundant during this period, and would without fail deprive the inhabitants of Quebec of electric lighting and car service. The arrangement is simplicity itself, by isolating an enlargement of the river on its west side (in front of the dam), and building a crib (ballasted with stone) until it reached the entrance, or neck to this enlargement or pond. This crib was 325 feet long, built parallel to the river's course in front of the dam, and contains seven submerged openings 6 ft. x 12 ft. for the admission of water to stilling pond in inside of crib where entrance to feeder pipe is located. This crib or guard pier is sheathed with heavy planking on side next current of river so as to deflect ice and debris of all kinds, thereby remaining in the river's current and passing over the dam. The result justified the expectations of the company's engineer, and has proven an admirable way of getting rid of this winter trouble to a water power plant.

THE FEEDER PIPE.

The grading for the feeder pipe proved to be no slight piece of work, winding, as it does, snakelike along a steep hillside which

rises to an elevation of almost 300 feet from the St. Lawrence river, sometimes cutting through steep bluffs of rock and again crossing deep and dangerous ravines on the bluff. The feeder pipe is constructed of first grade tank steel, 2,609 feet long from dam to power house, 1,509 feet of its length being 8 feet diameter by ¼ of an inch thick, and having only a slight declination in that distance, the remaining 1100 feet beginning to decline rapidly to the power house, and being 6 feet diameter by ⅜ of an inch thick, the remainder of pipe being ½ inch thick. The seams on the circumference are single riveted. Horizontal seams are double riveted, all rivets ¾ of an inch in diameter.

When all the turbines are running with a "peak load," the rate of flow of the water in the main feeder pipe is 5 feet per second. For such a long length of feeder pipe, containing such a volume of water, it was found necessary to provide means to counteract the fluctuating impetus or oscillation (of the immense quantity of water contained in the pipe) due to the opening and closing of turbine gates, caused by changes of load on generators running both of their railroad systems. For two reasons it was necessary this oscillation should be counteracted ; to prevent rupture of pipe, and to allow governors to regulate change of load only, and not to be affected by fluctuations of water, the last reason being a very important consideration for steady service where water is the motive power.

To remedy these faults, it was decided to erect two stand pipes (as being superior to relief valves), No. 1 stand pipe being placed almost immediately outside of the power house. The foundation for the stand pipe was placed 75 feet above power house, and the pipe as erected stands 150 feet high and six feet in diameter, housed from top to bottom with a 4 inch air space to prevent freezing during the winter. No. 2 stand pipe was erected midway between the dam and power house, being 4 feet diameter and 45 feet high. It has a counter fluctuating effect on the action of No. 1 stand pipe. The entire arrangement has proved exceedingly satisfactory, and is one of the many important factors which have resulted in giving steady lighting service, a condition which is the desideratum of electricians and users of the electric current.

POWER HOUSE.

The power house is a substantially built stone structure of two stories, 40 feet wide by 150 feet long, and 45 feet in height from lower floor to apex of roof. The interior being the point of interest, I will proceed with an account, first, of the hydraulic machinery, which has created so much interest and criticism; this consists of five units for generating current and two small units for excitation. The turbines recently installed are the first of their kind in use, and are designated the "Victor High Pressure Wheel." There is no question, as has been demonstrated by recent tests, but that this is the "ideal" high head turbine, and the builders are to be congratulated on having attained such a perfect wheel, after many trials, vicissitudes and disappointments. At the official test made by competent hydraulic and electrical engineers appointed by the Quebec Railway, Light & Power Co., the turbines at half gate gave an undisputed efficiency of 78 per cent., as shown in the annexed diagram submitted, to which is appended the signature of the company's engineer and manager who supervised the test. The diagram of power, water and efficiency curves as shown are self explanatory, and the interested reader will easily comprehend them without further comment thereon.

The water wheels or turbines are 54 inches diameter and make 286 revolutions per minute. Each of the five units has a capacity of 1,000 horse power under a head of water 260 feet high. The wheel shaft is coupled direct to generator shaft with flange couplings, with the usual fibre plate and bolt bushings to insure perfect insulation. The bearings on water wheel are of the ring oiling swivel box type.

The wheels when running are free from the noise of breaking water, jar and other detrimental qualities hitherto difficult to eliminate, yet so common in high head wheels, which finally

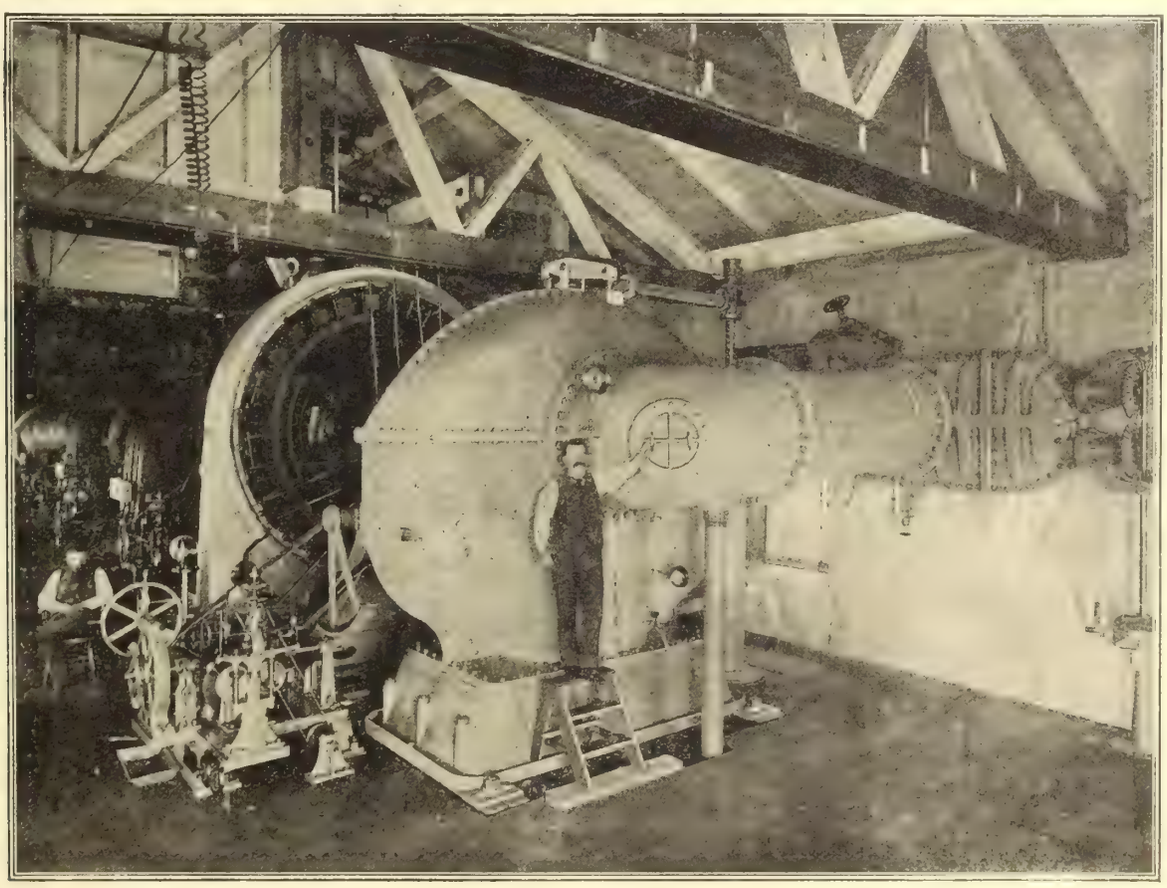


FIG. 2.—1,000 H. P. VICTOR HIGH PRESSURE TURBINE DIRECT CONNECTED TO GENERATOR.



FIG. 3. THE HYDRAULIC CRIB.

destroy the wheels by perforating the buckets, chute guides and other parts exposed to the impingement of the water. All parts of the turbine are easily got at for examination. In the design provision has also been made to prevent frazil or anchor ice interfering with the running of the wheels or the operation of the gate in the chute case.

The Victor high head wheel is also provided with an air chamber (situated between wall and case), in which there is a float attached by a tube to an air valve (at top of air chamber) for admission of air to wheel case and draft tube, to maintain a partial vacuum, to retain the water in case of a constant level below the wheel, irrespective of amount of gate opening.

By referring to the illustrations the reader will comprehend the general construction more clearly than can be furnished by explanations.

Close by the wheel settings and attached to each one of them is a 36 inch gate valve, which is provided with a 6 inch by-pass pipe and valve, so as to enable the 36 inch valve to be opened easily by equalizing the pressure on both sides, otherwise they would have to be opened against a pressure of 36 tons. For regulating variation of speed of wheels and generators due to change of load, there is attached to each turbine a Giesler mechanical electrical governor, which governs unerringly, under the most adverse conditions, the electrical load for railroad, motor or lighting purposes. These governors are probably as interesting a piece of mechanism as is constructed at the present day, but to explain the details of the design would require diagrammatic illustrations, which are outside the scope of this article. With a constantly varying change of load on the street railroad circuit, the Giesler governor on this plant regulates the speed, as shown by the tachometer, within a 3 per cent. variation (in 286 revolutions), and on incandescent and arc lighting units the variation never exceeds 2 per cent. In the event of a line wire breaking, circuit breaker flying out, or any sudden removal of the load, the governor will shut gate within the space of three seconds to a sufficient opening to keep wheel running at normal speed.

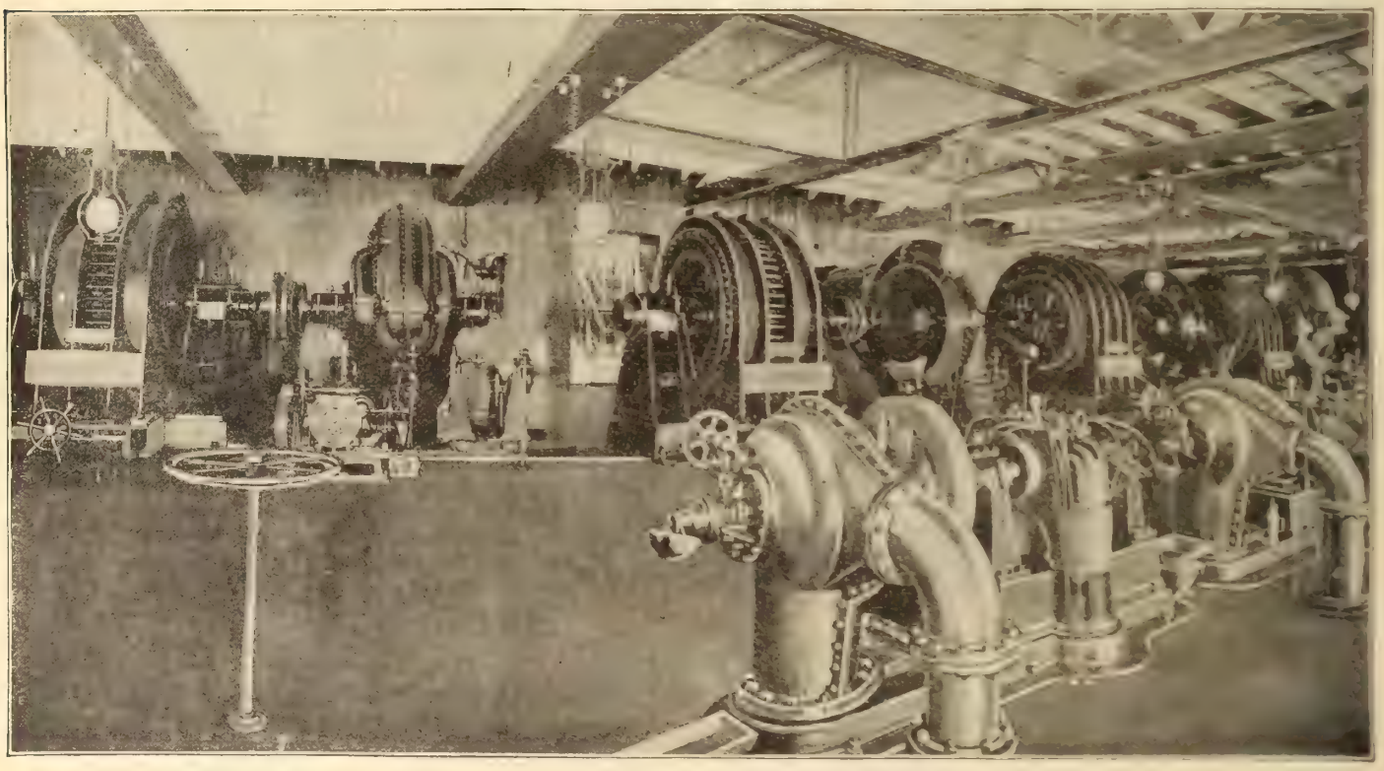


Fig. 4.—Broadside View in Power House—Exciters and Their Turbines in Foreground.

ELECTRICAL EQUIPMENT.

The electrical equipment consists of five units, four of the generators being of the S.K.C. system, voltage 5,500, kilowatts 600, alternations 8,000, revolutions 286 per minute. The S. K. C. generators are of the induction type and have proved beyond question that the alternating generator is a most reliable and serviceable system, suitable for the general distribution of light and power simultaneously from the same generator and circuit at frequencies which are economical. The S.K.C. two-phase system has been and is operated under a great diversity of conditions, such as high voltage, low voltage, under and overhead circuits, three and four wires, etc. As has been demonstrated in this plant, the results have been perfectly satisfactory, and since they were placed on their foundations, three years ago, have never given any trouble nor failed to meet the requirements, although in service night and day during that period. These four units are interchangeable, and can be used on any circuit in the city of Quebec from the distributing station there, for incandescent, arc, motor or street railway purposes.

The four S.K.C. units have an independent switchboard which contains nine white marble panels set in an oak frame, bolted to a stable foundation, and furnished with 4 volt-meters, 4 ammeters, and also four rubber shutters, quick arc breaking switches on each outside set of panels, with leads of No. 1 rubber covered wire to each respective unit. The center panels are provided with, on account of there being two exciters, 4 voltmeters, two potential volt-meters, 4 ammeters, also 4 two-throw two-pole switches for excitation purposes, all wiring being arranged to allow of any generator unit being excited from either of the two exciter dynamos.

In addition to the usual or independent switchboard just described, there is a transfer board provided with a suitable bus-bar arrangement which makes it possible to connect each generating unit on any transmitting circuit, between power and distributing stations. The fifth unit, installed within the last few months, is a Westinghouse double current generator, otherwise a direct and alternating current two-phase machine of 600 kilowatts, 400 volts, 8,000 alternations, 286 revolutions per minute. This machine has been previously described in these columns. The alternating current is transmitted to Ste. Anne's de Beaupre, distant only 15 miles, on a 3 wire line. This type of generator is used exclusively for electric railway and long distance transmission purposes. The direct current side of this generator is used to supply current to feed the line running adjacent to the power house by cable feeders with a voltage of 550, being a direct current feeder on the trolley wire where it passes the power house. The alternating current side of the generator delivers the current with a voltage of 400 to the step-up transformers in the power house, which increases the voltage to 11,000, and is transmitted direct to St. Anne's. The step-down transformers there reduce the current to 400 volts, which runs a rotary converter, which feeds the trolley wire with a voltage of 550 at that end of the road. This system has also a feeder from the Quebec city end of the line, and in this way is maintained an almost uniform strength of current and speed of cars from end to end of road.

This unit is provided with a switchboard consisting of 6 upright marble panels, with the usual necessary number of meters and switches. The circuit breakers are of the I. I. E. type. The high potential transmission lines have 3 special automatic combined non-arcing circuit breaking switches.

All of the electrical equipment and apparatus is protected effectively by the Wurts pyramidal form of lightning arresters with choke coils underneath.

The arresters installed here are sufficient for a 15,000 volt three wire alternating current power transmission circuit, and can be used on any number of phases.

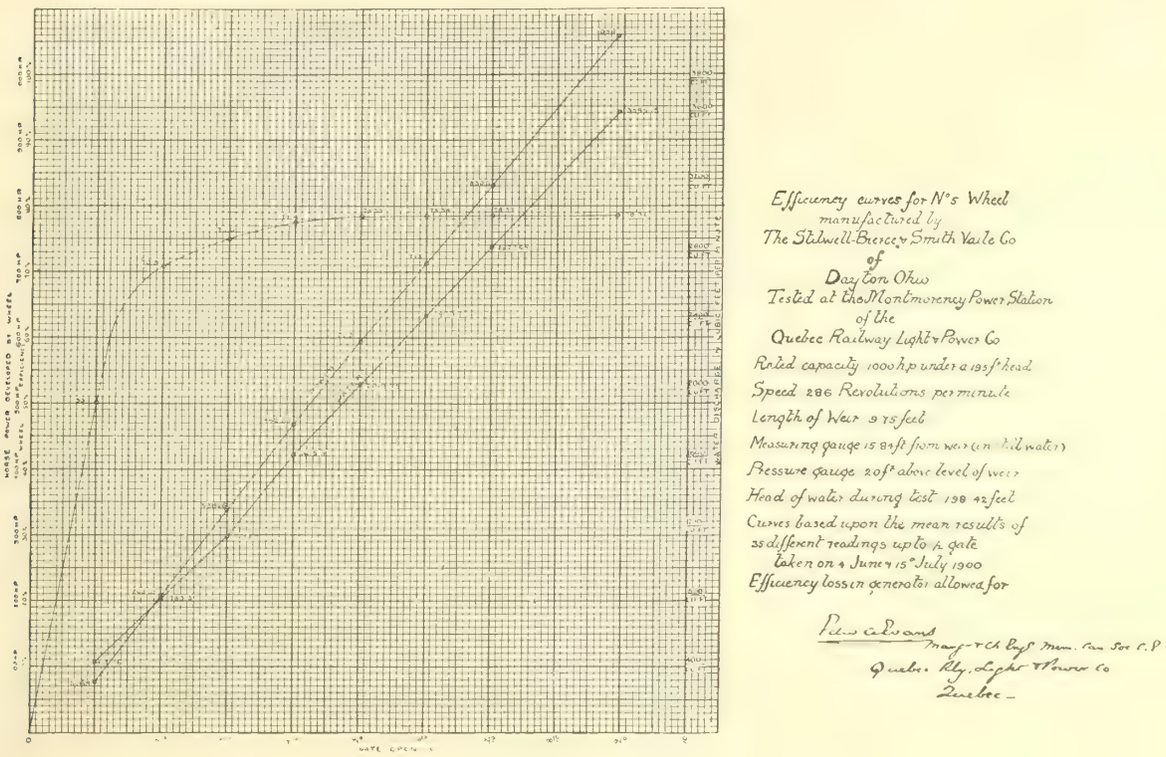


FIG. 5.—DIAGRAM SHOWING EFFICIENCY CURVES.

PERSONAL.

Edward A. Evans, general manager and chief engineer Quebec Railway, Light and Power Company.

Arthur Giesler, H.E. and chief engineer of the Stilwell-Bierce & Smith-Vaile Company, Dayton, Ohio, U.S.A., who are the designers and manufacturers of the Victor high head turbine.

W. A. Langford, superintendent and electrician for the Quebec Railway, Light and Power Company, and Geo. W. Bowie, H.E., who supervised the installation of the hydraulic work for the Stilwell-Bierce & Smith Vaile Company.

Since writing this article Mr. Bowie has severed his connection with the Stilwell-Bierce and Smith-Vaile Company and has accepted a position with the National Cash Register Company, of Dayton, Ohio, as first assistant of their engineering department.

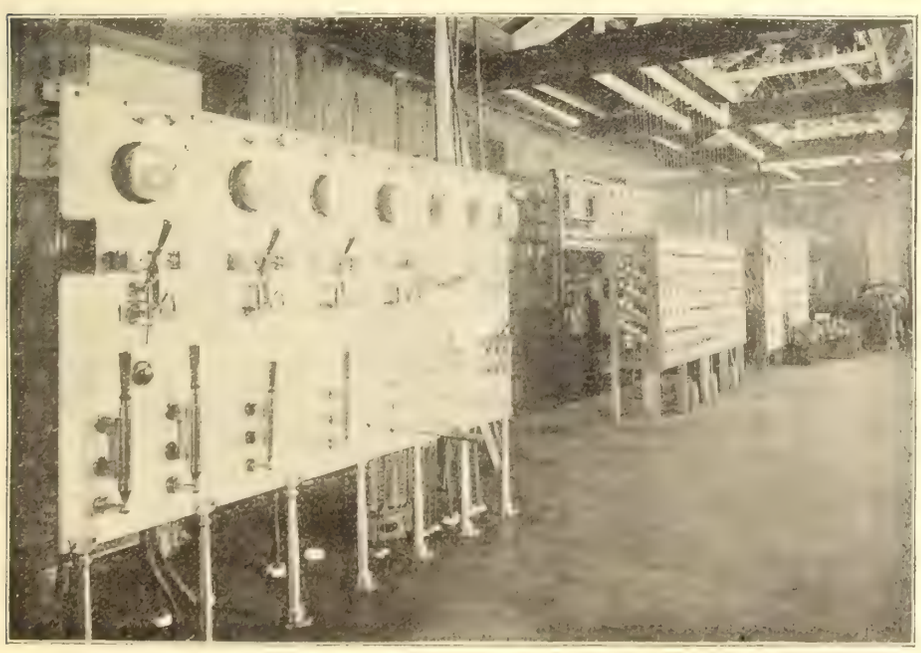


FIG. 6. THE SWITCHBOARD.

NEW ELECTRIC RAILWAY.

THE Woodstock, Thames Valley and Ingersoll Electric Railway, which started its first car over the finished section of the road from Woodstock to Beachville on October 8th, has been doing a good business ever since. We understand that often when the car starts there are two or three carloads of people waiting to take it. Other cars will be put on very soon, and as long as the weather will permit work on the line from Beachville to Ingersoll will be pushed ahead. The Von Echa Company, which is building this road, is anxious to finish it without delay, and if not compelled to shut down by cold, will run the cars into Ingersoll before spring. The work so far has been rapid and good, the best of material and labor being used throughout. The roadbed is for the most part built along the upper side of the turnpike, over land purchased in fee simple by the company. Seven foot cedar ties, 2½ foot centre, 30 foot chestnut and cedar poles, and 56 pound rails have been used. The power house is of brick, the car barn frame, and are built on opposite sides of the road, about one mile from Woodstock, but at about the electrical centre of the road, made so on account of the grades.

The adverse criticism which prevailed in many quarters until the car started and demonstrated the correctness of the ideas of the Von Echa Company, has rapidly veered, and now the people are congratulating themselves and the Von Echa Company. Requests are being made for bonds of the road, all of which are held by the Von Echa Company, which showed its faith in the road and in the country through which it is being built, by using its own money, making no appeal for cash, not seeking subsidies or trying to sell either stock or bonds.

The plant as yet is incomplete, only one engine, boiler, generator, etc., having been put in, but duplicate machinery and more cars will soon follow. In the spring freight cars will be added, when the road will be quite a model interurban enterprise, and do much to develop the rich farming country of Oxford county.

Dr. Moore is building a telephone line from Horning Mills to Whitfield, Ont.

QUESTIONS AND ANSWERS

"Subscriber" writes : In the November issue of the News you were kind enough to reply to an inquiry of ours under the nom de plume of "Subscriber," re primary effects on secondary wires. In reply to invitations for further particulars we would say that the line had been carefully examined for any swinging contacts, and none such existed. The effect is, however, intermittent ; sometimes the same part may be handled with impunity that at another time will promptly knock one down, nor does the weather make much difference, wet or dry. We have not run transformers hot, but have cut one after the other of the 4 banked on this line out, without any difference to the intensity of shock. Not having a static voltmeter, we cannot give the potential, but can, from personal experience, guarantee it well up in the hundreds, also that it is neither static nor a low voltage effect on sensitive constitutions ; several hands being severely burned by being pinned to socket or wire while handling same. The line was O.K. till some four months ago, no change being at that time made in it.

Ans.—We have again very carefully gone over your previous enquiry, and also the further details contained above, but regret that we can come to no definite conclusion in the matter. We presume that if you have a series arc circuit, running at the time the trouble was experienced, you have taken the precaution of shutting it down to see if a leak ftom it was not the cause. From your last letter we would judge that the potentials were high, and were not static, as you speak of severe burns having been inflicted. These possible sources being eliminated, there remains but a connection to a foreign line (such as the series arc circuit, referred to above), or to the primary. We would suggest that you obtain the use of a voltmeter with a range at least as high as your primary potential, and that if you fail to discover the trouble with its aid, you put the matter into the hands of one of the manufacturing companies for investigation, as it is not a state of affairs which it is wise to leave unremedied.

"Engineer" says: I have an engine running here with the main belt crossed. Would it not be a better plan to run it the other way, and thus have an open belt?

Ans.—The advisability of reversing the rotation of your engine depends entirely on its make. For instance, if it is equipped with a shaft governor contained by the fly wheel, you will have to get practically a new governor complete before you can run in the other direction, though if you have a pendulum type there will be no difficulty on this score, nothing being necessary but the reversion of the eccentric. Again, if you have a self-oiling type you will probably find it impossible to run it in any direction but that for which it originally was built, as the oil channels, grooves, etc., being supplied as a rule by centrifugal force throwing the oil into them, are adapted to receive the oil but from one direction only, and thus do not get any oil supply if the engine be run the other way. Again, the guides, together with the crosshead adjusting and oiling arrangements, are in many engines designed to take the side thrust of the piston and connecting rods on one side only, and are not designed so that these strains and frictions can be, with safety, transferred to the other guide.

A subscriber at Calgary writes : The purchase of a stone crusher is under consideration. It is expected to crush any size stone usually found in a gravel bed. I may say we have them as large as 14 inches in all directions, and they propose to use electric motive power. The only current available here is the alternating current, and the company are installing synchronous motors, which, of course, require to be brought up to speed by some outside agency, but even if they put in a direct current machine, will not the load be too variable? Will it be either profitable or practicable to run it by electricity, the load varying each time it strikes or completes the crushing of a stone from zero to full capacity of machine? Let it be understood that a heavy fly-wheel will be used.

Ans.—The running of stone crushers can most emphatically be accomplished by means of electric motors. It is of course desirable that all the details of the proposed plant should be submitted for competent investigation, but the following are the main points : Alternating motors are preferable to the direct current type because of their ability, due to the absence of moving contacts, to successfully withstand very large temporary overloads, which will always be encountered in this class of work, owing to irregularity in the feeding of the crusher, the occurrence of hard heads, etc. On the other hand, a direct current type, unless having a horse power capacity very much in excess of that required to run the crusher under normal loads, in which case the installation will become unnecessarily expensive, will give more or less trouble from sparking at the commutator, though this can be partially avoided by careful handling of the plant. We would say that, generally speaking, induction motors would be preferable to the synchronous type, because they will work under much larger voltage variations than will the latter, are easier to look after under the extreme conditions of dirt and dust usually prevailing in such work, are more simple and therefore require less skilled attendance, and will probably cost you less than will the latter. It is of course highly desirable that large balance wheel capacity should be installed, no matter what the motive power, and it is also advisable in order to avoid as much as possible the disturbance of the line voltage incident to the starting of a heavy machine such as this, that the motor be started first, and, after it is running, the crusher brought up to speed by means of a clutch or tight and loose pulleys. The question as to whether it will be profitable to operate your crusher electrically is one governed entirely by local conditions. In the absence of the details obtaining we are unable to give you an opinion; the interest on the cost of the plant, the cost of attendance, the cost of repairs, and the cost of fuel will form the basis on which to calculate the expense of operating by steam or gas or fuel oil; the outlay for electrical operation will be made up of the same components, excepting that the price paid for current will be substituted for the cost of fuel.

E. F. Valiquet, Marlbank, Ont., referring to the question in November number as to which side of a belt should be placed next the pulley, asks whether the flesh or grain side is the smooth side, as he was always told to put the smooth side next the pulley.

Ans.—The flesh or grain side of a belt is the side which has the network of lines running all over it, being the impressions left by the veins and arteries of the animal; the bright, hard, smooth side, with the somewhat pitted or pebbly appearance, is the hair side.

"Dynamo Tender" writes : There are several spots of oil on our switchboard, which I would like to take out if possible. Can you tell me anything which would do for the purpose?

Ans.—The use of ordinary washing soda and vinegar will usually clean out most spots. Lay the marble down flat if possible, put the soda over the spot to be cleaned and pour on the vinegar, thus making the reactions to take place on top of the oil. It is possible, of course, by this means to get at only the oil near the surface of the marble; very possibly the oil which is further in will soak out after a few weeks, in which case the operation will have to be repeated.

The Canadian Electric Light Company, of Quebec, have secured the contract for lighting the streets of Levis, Que., electrically.

Several gentlemen met in Essex, Ont., on December 15th and made arrangements to obtain a charter for the construction of an electric railway from Windsor to a point on the lake shore.

CORRESPONDENCE.

BRAKES FOR STREET CARS.

TORONTO, Jan. 3rd, 1901.

Editor CANADIAN ELECTRICAL NEWS:

DEAR SIR,—In your issue for December last your Montreal correspondent writes you regarding the running away of a car in Montreal city, which had but then recently taken place, and calling attention to the necessity for better brakes.

In connection with this I would point out that with a car equipped with two or more motors and any of the modern type of controllers, the motorman possesses in the reversibility of the motors a brake almost as quick, and certainly as reliable for emergency work as any air or power brake now on the market. If the reversing of the motors with either the trolley on or off will not hold the car, it means that the wheels are slipping, and that the car cannot be held by any style of brake, through its own wheels, but must be controlled by some device such as a track brake, which class of apparatus has not up to the present been commercially perfected.

Yours truly,

A. B. LAMBE, Jr.

EQUIPMENT OE THE CATARACT POWER COMPANY.

TORONTO, Dec. 31st, 1901.

Edito: CANAD AN ELECTRIC AL NEWS:

DEAR SIR,—I picked up in our Toronto office to-day a copy of your CANADIAN ELECTRICAL NEWS for December, and note with interest your editorial on the Cataract Power Company. Evidently you have been mis-informed in some respects as to the apparatus used by this company, as it was not all furnished by the Royal Electric Company. The three 300 k w. rotary converters referred to in the article, with complete switch-board apparatus therefor, was supplied by the Westinghouse Electric & Mfg. Company. We have also furnished to the Cataract Power Company a number of induction motors and transformers aggregating over 1000 horse power in capacity.

I also note with interest your item in regard to the Chambly power plant, in which you mention that it is intended to put in ten 2000 k. w. air blast transformers. It may be of interest to you to know that these transformers and a similar equipment for the receiving station in Montreal are being built by the Westinghouse Company.

Yours very truly,

T. C. FRENYEAR, Manager.

SELECTION OF ITALIAN TURBINES.

MONTREAL, DEC. 18, 1900.

Editor CANADIAN ELECTRICAL NEWS:

DEAR SIR,—Replying to your enquiry, I furnish the following information. About three years ago the Cataract Power Company, of Hamilton, decided to develop a water power—267 feet head—for electrical purposes, near St. Catharines, Ont. The design contemplated four units—four horizontal turbines of 1,500 h.p. each, driving four direct connected generators of 1,000 k.w. each, at 400 r.p.m. A contract was awarded to an American company of turbine builders who claimed to be making a specialty of high head turbines. The contract embraced, in part, two turbines, with all necessary valves, supply pipes, draft tubes, governors, etc., erected in place complete ; also the draft tubes and foundation works under floor level for the remaining two turbines. The contractors furnished their own designs throughout, and guaranteed the turbines to have a certain efficiency. The instalment was made, but the turbines failed in the efficiency test. As good efficiency was very important to the Cataract Power Company, the turbines were not accepted.

After starting the works the writer made a trip to Europe, and although the trip was primarily for health and pleasure, I took opportunity of visiting some interesting water power developments in Italy, Switzerland and Austria, as well as the works of some of the best known turbine builders. Almost immediately after my return to Canada the Cataract Power Company decided to complete their power plant, but further decided to double the capacity of the two remaining units by making them each 3,000 h.p. turbines and 2,000 k.w. generators. I recommended the company to take tenders in Europe as well as in America for the turbines and their accessories ; and acting under instructions from the company, through their manager, I prepared general specifications for the proposed turbines, etc. As the inlet pipes, draft tubes and turbine foundations had already been placed for the smaller turbines, it was important that these, as far as possible, be utilized for the larger, and that the design for the new turbines and the space to be occupied conform, as nearly as possible, to the original designs.

To faciliate matters I visited England, Switzerland, Budapest, (Hungary), and Italy, and got tenders from turbine builders in all of these countries. The result was the acceptance of a tender from Milan, Italy. The turbines have since been received and one has been erected and is now at work. I feel satisfied that the results obtained, in design, cost, efficiency, etc., justified the placing of the contract as was done. Two tenders were received from the United States.

The contractors for the first two turbines—the American company— subsequently sent their mechanical superintendent to Europe and received, in Switzerland, designs for turbines to replace those first installed. Turbines from the Swiss design have been made and will replace the old as soon as the Italian turbines are fully at work.

I know of no Canadian turbine builders who have had the necessary experience in the design and construction of turbines for the conditions imposed and the very high head of water utilized by the Cataract Power Company, and to this I may add that the American company who made the first turbines were on about equal footing in this respect with the Canadian turbine builders. In Switzerland, Austria and Italy there are many water powers where the head of water is very high—hundreds of feet—but the quantity of water is quite limited. These conditions have led to the design and construction of turbines for high heads to a degree of efficiency hitherto unknown in this country.

The general practice in Europe is to design each turbine for the conditions under which it is required to work. The general practice in this country has been to build the turbine and then adapt the conditions as well as possible to the turbine.

Yours truly,

WM. KENNEDY, JR.

TORONTO ELECTRIC LIGHT COMPANY.

The Toronto Electric Light Company have recently completed a building 68 x 170 feet, to be used as machine and carpenter and pattern shops. The machinery plant which was used in the company's old machine shop has been installed in the new building, and additional lathes and other machinery of larger capacity will be added. Gallaries extend along both sides of the machine shop and occupy about one-half of the width of the building. The space in these gallaries will probably be used for manufacturing electrical supplies. It may not be generally known that the company manufacture their own arc lamps, switch-boards, and instruments. In the rear of this new building is to be erected a new boiler, engine, and dynamo room to relieve the present dynamo room, which is overcrowded, and to afford space for a new 1,500 h. p. compound engine now in course of construction. The company has been short of engine and boiler capacity for some time past, and are hurrying forward the completion of this additional equipment as speedily as possible. Two new boilers have recently been installed in the present boiler room which will afford a measure of temporary relief.

EAST TORONTO MUNICIPAL PLANT.

THE village of East Toronto have now their plant in running order and furnishing light to consumers. The street lights, 23 in number, are giving good satisfaction, and the neighboring village of Little York are negotiating for their street lighting from the East Toronto plant. The plant is in a neat and spacious brick power house, built at a remarkably low figure for the size and construction of the building, and contains the Brown engine and boiler and a Canadian General 60 k.w. alternator, switch-board and apparatus. It was at one time the intention to place the plant in a corner of a frame mill, and rent power, but the town council have acted wisely in carring out the the expert's advice and building their own power house. The plant was installed from plans and specifications prepared by H. F. Strickland, electrical expert.

Messrs. Ely & Turner have made a proposition to the council of Wiarton, Ont., to establish an electric ligth plant in that town.

The Dawson City Electric Company, Limited, will apply for legislation to extend the time for the completion of its electric railway.

ELECTRICAL APPARATUS AT McGILL.

THE following list of apparatus, forming the electrical equipment of the McDonald Engineering Building of McGill University, was received too late to accompany the descriptive article appearing in last issue :

GENERATING PLANT :—One 75 K.W. 125 v., D.C., M.P. generator, Crocker-Wheeler Co., direct connected to a horizontal side crank engine, Robb Engineering Co.; one 75 K.W., 125 v., D.C., M.P. generator, Canadian General Electric Co., direct connected to a horizontal central crank engine, Goldie & McCulloch Co.; one 30 K.W., 105 v., D.C., B.P. generator, Siemens Bros. & Co., direct connected to a vertical central crank engine, Williams & Robinson ; one 30 K.W., D.C., B.P. generator, Mather & Platt, direct connected to a vertical central crank engine, Williams & Robinson ; one 7 K.W., 110-40 v., D.C., M.P., motor generator, Sprague Electric Co.; one 4 panel switchboard, with instruments, switches, circuit breakers and cell charging apparatus.

A. C. DYNAMO LABORATORY :—One 15 K. W., 220 v., 1-2-3 phase A.C. generator, revolving field type, Canadian General Electric Co., driven by a 40 H.P., D.C., M.P. variable speed motor, Canadian General Electric Co.; one 15 K.W., 220 v., 2-phase alternator, inductor type, S.K.C. system, Royal Electric Co., driven by a 25 H.P., D.C., M.P., variable speed motor, Crocker Wheeler Co.; one 15 K.W., 100-1000 v. single phase alternator, inductor type, Warren Electric Mfg. Co., driven by a 20 H.P., D.C., M.P. variable speed motor, Crockor-Wheeler Co.; one 12 K.W., 100-1000 v. single phase alternator, Brush Electric Eng. Co., driven by a 15 H.P., D.C., M.P., variable speed motor ; one 20 K.W., 1-2-3 phase double ended rotary converter, Westinghouse Electric & Mfg. Co.; two 10 K.W., 1-2-3 phase rotary converters, Westinghouse Electric & Mfg. Co.; one 2 H.P., A.C., M.P. motor (S.K.C. system), Royal Electric Co.; one 5 H.P., A. C., M.P., single phase motor, Wagner Electric Mfg. Co.; one 3 H.P., A.C., M.P. induction motor, Westinghouse Electric & Mfg. Co.; one 10 H.P., A.C., M.P. 2-3 phase induction motor arranged as a frequency changer, Canadian General Electric Co., driven by a 10 H.P., D.C., M.P. variable speed motor, Crocker-Wheeler Co.; to vary and regulate speed of motors, field and armature rheostats made by the Cutter Electric Mfg. Co. are provided.

D. C. DYNAMO LABORATORY :—One 16 light, 10 ampere, T.H. arc dynamo, Royal Electric Co., driven by a 20 H.P., D.C., M. P. motor, Westinghouse Electric & Mfg. Co.; one 16 light 10 ampere wood arc dynamo, Fort Wayne Electric Co., driven by a 16 H.P., D.C., bi-polar motor (Edison), Canadian General Electric Co.; one 10 light 10 ampere arc dynamo, Brush Electric Co., driven by a 16 H.P., D.C. bi-polar motor (Edison), Canadian General Electric Co.; one 5 K.W., D.C., M.P. dynamotor, Brush Electric Eng. Co., driven by a 7.5 H.P., D.C., M.P. motor (Victoria), Brush Electric Eng. Co.; one 15 H.P., 500 v., M.P. street railway motor, Canadian General Electric Co.; one 5 H.P., 110 v., D.C., M.P. motor, Royal Electric Co.; one 15 H.P., 110 v., D.C. bi-polar motor, Thomson-Houston Co.; two 3 H.P., 110 v., D.C. motors (fan type), Sprague Electric Co.; one 2-5 H.P., 110 v., D.C. motor, Canadian General Electric Co.; a number of small machines, from 1-20 to 1-2 H.P., of the following makers: Crocker Wheeler Electric Co., Sprague Electric Co., Lundell & Co., General Electric Co.

STANDARDIZING LABORATORY :—Four range 0-0.1-1.0 ; 0-10 ; 0-100 ; 0-600 amperes standard Kelvin balances ; one range 0-5,000-10,000 Kelvin electro static voltmeter ; one range 0-150 standard Kelvin multicellular voltmeter ; one range 0-110 Kelvin multicellular voltmeter ; one range 0-1.5-15-30-150-600 standard Weston D.C. ammeter ; one range 0-3-150-600-1,500-3,000 standard Weston D.C. voltmeter ; one range 0-1,500 ampere 0-3,000 volt potentiometer, Elliott Bros.; one d'Arsonval bi-filar galvanometer, Crompton & Co.; one high resistance Thomson galvanometer for insulation testing ; three D'Arsonval galvanometers, Nalder & Co.; one 1.5 standard resistance, Elliott Bros.; one 1-10-15 amp. standard resistance, Elliott Bros.; two standard ohms, Nalder Bros.; one Carhart-Clarke standard cell ; one Muirhead's patent standard cell ; two Hibbert standard cells, Elliott Bros.; one range 0-11000 Wheatstone bridge, Nalder Bros.; one range 0-2000 Wheatstone bridge, Nalder Bros.; one range 0-100000 resistance box ; one range 0-10000 testing set, E. S. Greeley & Co.; one continuously variable voltage transformer for A.C. voltmeter calibration, Royal Electric Co.; one 0 to 8 volt 800 amp. transformer for ammeter calibration ; one phase shifter, Westinghouse Electric & Mfg. Co.; one Ewing permeability bridge ; one Ewing hysterisis tester ; three standard condensors, ranges 1-2-1-1 M. F., Elliott Bros.; one standard condensor, range 0.05-0.5 M. F., Nalder Bros.; one 4.5 K. W. 110-10 volt D.C., B.P. motor generator, carbon rheostats, large capacity potentiometers, etc., etc.

HIGH TENSION LABORATORY :—Four 10 K.W. 200-50000 volt transformers, Westinghouse Electric & Mfg. Co.; one 20 K. W. 200-200 volt insulating transformers, Westinghouse ; switchboard with full complement of controlling apparatus, including Stillwell regulator, impedance coils, etc.; one 15000-150000 volt Kelvin electrostatic voltmeter ; ammeters, voltmeters, wattmeters, etc.

RESEARCH LABORATORY :—Small A.C. & D.C. generators and motors ; constant current transformers of different types and classes ; constant voltage transformers of different types and classes ; tables for special work, supplied with currents of different kinds and at any desired voltage ; a various assortment of special instruments.

OTHER INSTRUMENTS :—Two Stanley hot wire ammeters ; two Siemens electro-dynamometers ; twenty Thompson ammeters, voltmeters and wattmeters ; ten Nalder ammeters and voltmeters ; sixty Weston ammeters, voltmeters and wattmeters ; two Cardew voltmeters ; six recording wattmeters, various types ; twenty-five ammeters, voltmeters and wattmeters, miscellaneaous types ; four magneto generators with special multi-voltmeters (used as speed indicators), Weston Electric Inst. Co.; six revolution counters ; two mechanical speed indicators ; contact makers for each A.C. machine ; six current transformers ; three sets of 64 11 plate type E Chloride accumulators, 25 K.W. hour capacity, 8 hour discharge rating, the Electric Storage Battery Co.; one hundred 3 plate type B Chloride accumulators, for voltmeter calibration, the Electric Storage Battery Co.; one-quarter panel battery switchboard equipped with instruments, circuit breakers, etc.; one-sixth panel distributing switchboard, A.C. and D.C. dynamo laboratories ; one main panel switchboard with instruments and circuit breaker dynamo laboratory ; twenty-five arc lamps with switchboard ; one-fifth K.W. 110-40 v. D.C. motor generator, for charging accumulators, the Crocker, Wheller Co.; seven commercial condersors, adjustable capacity, the Royal Electric Co.; a great variety of transformer and potential regulators ; seven absorption dynamometers for motor testing; one transmission dynamometers for motor testing; specially designed tables, wired and equipped with switches, circuit breakers, etc., for each pair of machines (motor and dynamo) to facilitate experimental work.



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(Mention the CANADIAN ELECTRICAL NEWS.)

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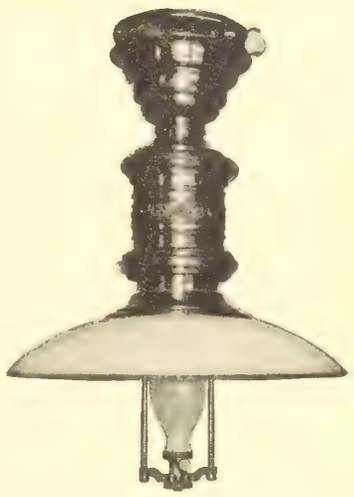
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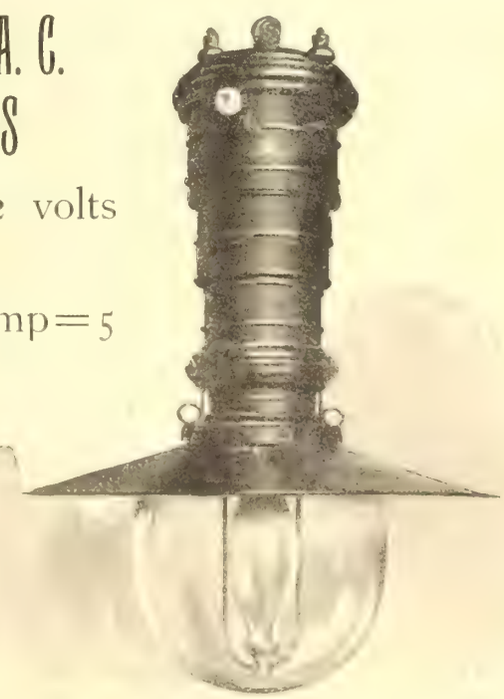
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SPARKS.

An electric light plant is being established in the village of Coldwater, Ont.

A movement is on foot to secure the establishment of an electric light plant in the village of Wellesley, Ont.

The ratepayers of Lindsay, Ont., have voted in favor of the town assuming control of the electric light plant.

A plebiscite will likely be taken in Charlottetown, P.E.I., in February on the question of municipal control of the electric light plant.

The town of Dartmouth, N.S., will ask authority from the provincial legislature to borrow $40,000 for the purchase of an electric light plant.

The by-law to provide for the taking over of the electric light plant by the corporation has been carried by the ratepayers of Blenheim, Ont.

Messrs. Cook Bros., of Hensall, Ont., have installed an electric light plant at Lucan, and have secured the contract for lighting the village.

It is the intention of the provincial secretary to make arrangements for the electric lighting of the Brockville asylum. A private plant may be installed.

Electricity will be used in future in lighting the switches of the Grand Trunk railway yards in Toronto, an electric swith lamp having at last been accepted by the company.

A by-law was carried by the ratepayers of Parry Sound, Ont., on January 7th to provide $29,500 for the purchase of an electric light plant and for waterworks improvements.

Mr. Mike King is applying to the Brtish Columbia Legislature for a charter to enable him to provide Queen Charlotte Island with railway, telegraph and telephone systems.

Messrs. McDougall, Brandon & Austin are using electric power in connection with their farm operations near Fenelon Falls, Ont. They also have their buildings lighted electrically.

The Sun Oil Refining Co., of Hamilton, have recently installed one of the Smart-Eby Machine Company's duplex steam pumps for handling heavy oil, also a 50,000 gallon steel oil tank.

Mr. Charles Fawcette, of Sackville, N. B., is negotiating for taking over the telephone system of the Campbellton Telephone Company, with a view to extending the long distance line northward.

The Alaska Exploration Company, a syndicate capitalized in England, has laid plans before the Yukon council for a million dollar line of street railway through the main street of Dawson and out to the creeks.

La Compagnie Pontbriand, Sorel, Que., has been incorporated, with a capital of $100,000, to manufacture engines, boilers, etc. The charter members include : A. E. Pontbriand, J. E. A. Pontbriand and J. T. Hurteau, all of Sorel.

The Bell Telephone Company have issued their Western Telephone Directory, by which we notice that Galt leads in the number of subscribers among the towns and even one of the cities, and runs very close to some of the newer cities.

Mr. Blossom, the New York expert engaged to report on the electric light and gas systems of the city of Brockville, Ont., is in favor of combining the gas and electric light plants in one central station and building an entirely new system, at an estimated cost of $125,000.

Messrs. Robertson & Robertson, of Victoria, B. C., will apply at the next session of the provincial legislature for the incorporation of a company to construct telephone lines and transmit electric power within the districts of Esquimalt, Victoria city and North and South Victoria.

Justice Colt, of the United States Circuit Court, has decided in favor of the American Bell Telephone Company in the royalty suit brought by the Western Union Telegraph Company The suit is known as the stock sticker case, and bad been in the courts since 1894. The amount involved was $12,000,000.

The John S. Hogg Company, of Galt, has recently installed one of the Smart-Eby Machine Co.'s (Hamilton) patent peat dryers, which is said to be doing excellent work. Mr. C. A. Matheson, of Perth, has placed his order with the same firm for one of their patent peat drying machines.

The directors of the Niagara, St. Catharines & Toronto Railway Company, at a meeting held towards the end of December, decided to build their road westerly to Hamilton at the earliest possible date. Preliminary surveys have been made by Mr. J. H. Armstrong, chief engineer of the company.

Mr. George H. Colins, of Greenwood, B. C., has sold to Nelson capitalists his interest in the Greewood and Phœnix Tramway and the Greenwood Electric Light Company. It is understood that next spring it is proposed to commence work on building the tramway between Greenwood and Phœnix.

Messrs. B. B. Law, James Burrill, J. H. Killam, E. K. Spinney and George Bingay are applying for incorporation as the Bay Shore Railway Company, Limited, with a capital of $250,000. The purpose is to construct a line of street railway from Yarmouth to Port Maitland, N. S., a distance of about twelve miles.

The Dominion Government will be asked to grant a charter of incorporation to the Ottawa & Hull Power & Manufacturing Company, of Hull, Que., the purpose being to develop the Chaudiere water power and to build pulp and paper mills, etc. Messrs. W. C. Edwards, of Rockland, and Hiram Robinson and H. K. Egan, of Ottawa, are interested.

Mrs. Ayrton, who is well known for her researches in the field of electricity, recently had the honor of dining with the three hundred and sixty members and guests of the Institution of Electrical Engineers at the Hotel Cecil in London. Mrs. Ayrton a short time ago submitted a thoroughly scientific essay on "The Hissing of the Electric Arc," a subject which she is still investigating.

The Bell Telephone Company have just removed their Cornwall office into new and commodious quarters. There are four switchboards in the operating room, three of one hundred wires each for local subscribers, and one for long distance work. They are of the metallic circuit type and provided with long distance transmitters and new pattern key-boards. Mr. James K. Cokers is the local manager.

The municipal water power project at Bracebridge, Ont., is not making rapid progress. After a certain portion of the work had been done, the council in December last again asked contractors to tender for the construction of timber dam, canal, power house and tail race, but only one tender was submitted, it being in the neighborhood of $12,000. This was considered too high, and the council decided to continue the work by day labor.

Mr. Thomas A. Edison has just perfected a new device for heating compressed air which,he asserts, at the same time utilizes all the store energy of coal and obtains fully 95 per cent. of it. "My invention," he says, "is a device for heating compressed air so that the losses in compression and utilizing as power are not only made up, but it is possible to get power through air compression for less coal per horse power than through the steam engine."

The Quebec District Railway last week made a trial of the Weldon-Conway automatic safety brake fender. The test was considered satisfactory, and all the cars of this system will likely be equipped with it. With this fender the brake is automatically applied and all power shut off as soon as the fender touches any obstruction, or the same effect may be brought about by the motorman with one movement of his hand. The brake consists of a sleeve and friction wheel on the axle which releases and again clutches at every revolution of the car wheel, thus preventing too sudden stopping. The front bar of the fender is immovable, and when struck a very light blow recedes and trips the fender till it runs along on the pavement itself.

About two months ago a committee was appointed by the city council of Montreal to report on the best cource to adopt in regard to electric lighting upon the expiration of the present contract with the Royal Electric Company. This committee does not favor municipal ownership, but recommends that public tenders for the new lighting contract be called for, and that the specifications contain certain conditions which do not apply to the present contract. The following objections to municipal ownership are given : That it would cost the city an immense sum to purchase such plant ; that the city would find it costly to operate such plant by steam power ; that there was but little outlook of getting water power, without purchasing it from companies,on account of so many water power companies operating water plants in the vicinity of Montreal ; that if water power was bought it would cost the city as much to manufacture electricity as if produced by coal ; and finally, under these conditions it would be better to give the lighting out by contract and to have the keenest competition.

MOONLIGHT SCHEDULE FOR FEBRUARY.

Day of Month.	Light.	Extinguish.	No. of Hours
	H.M.	H.M.	H.M.
1....	No Light.	No Light.	
2 ...	No Light.	No Light.	
3....	No Light.	No Light.	
4....	P.M. 5.40	P.M. 8.00	2.20
5....	" 5.40	" 9.00	3.20
6....	" 5.40	" 10.00	4.20
7....	" 5.40	" 11.00	5.20
8....	" 5.40	" 0.00	6.20
9....	" 5.40	A.M. 1.00	7.20
10....	" 6.00	" 2.00	8.00
11....	" 6.00	" 3.00	9.00
12....	" 6.00	" 4.00	10.00
13....	" 6.00	" 4.45	10.45
14....	" 6.00	" 6.00	12.00
15....	" 6.00	" 6.00	12.00
16....	" 6.00	" 6.00	12.00
17 ...	" 6.00	" 6.00	12.00
18....	" 6.00	" 6.00	12.00
19....	" 6.00	" 6.00	12.00
20....	" 6.00	" 6.00	12.00
21....	" 6.00	" 6.00	12.00
22....	" 6.00	" 6.00	12.00
23....	" 10.00	" 6.00	8.00
24....	" 11.00	" 6.00	7.00
26....	" 0.15	" 6.00	5.45
27....	A.M. 1.00	" 6.00	5.00
28....	" 2.00	" 6.00	4.00
		Total.....	204.30.

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TORONTO STATIONARY ENGINEERS' ASSOCIATION.

Some good work is being done this winter by Toronto No. 1, C. A. S. E. Lectures have been delivered by Mr. A. M. Wickens on "Economy in the Engine Room," and by Mr. G. C. Robb, chief engineer of the Boiler Inspection Company, on "Practical Experiments on Boilers and Steam." At the December meeting a talk was also given on "Mathematics" by Mr. Miller, of the American School of Correspondence. These lectures have been well attended and are proving very interesting and beneficial, and as a result the Association is increasing its membership. A lecture has been promised by Mr. O. P. St. John, and at the meeting on Wednesday, January 16th, Mr. E. J. Philip will give a talk on "Electricity." A committee has been appointed to arrange for the annual At Home, which will likely be held in February.

PRESENTATION TO MR. YULE.

On Christmas day Mr. John Yule, manager of the Guelph Light & Power Company, was made the recipient of an exceedingly handsome Waltham gold watch from the Canadian Electrical Association, in recognition of his untiring efforts in behalf of that Association, and particularly as chairman of the Legislation Committee. The inner cover of the watch bore the following inscription: "To John Yule, as an expression of appreciation of his earnest, unselfish and successful efforts in behalf of the Canadian Electrical Association, this token is presented by the members, in pursuance of a resolution adopted unanimously at the convention held August 29, 30th and 31st, 1900, at Kingston, Ont." The presentation was made through Mr. J. A. Kammerer, chairman of the committee appointed for that purpose. Mr. Yule was for two years president of the Canadian Electrical Association, and during his term of office he succeeded in greatly widening the influence of the organization.

PUBLICATIONS.

The National Carbon Company, of Cleveland, Ohio, are again sending out to their friends and customers a neat calendar accompanied by the moonlight schedule for the year 1901.

A neat catalogue descriptive and illustrative of the high tension storage battery as manufactured by the Volta Electric Storage Company, of Hamilton, Ont., has reached us. Particulars are given therein of the construction and characteristic features of the Edgerton battery, which may be used with advantage for many purposes, including electro-mobiles; in electric light and power stations; for operating street cars; for lighting railroad tracks in advance of moving trains; for sea-going vessels and other boats; for mining operations; for dental, medical and laboratory purposes, etc. Its use in connection with windmills has been demonstrated by Mr. J. Moodie jr., who has employed a windmill for operating the Volta electric storage battery for lighting his summer residence and grounds at Burlington Beach, and who states that since its installation in May last he has never been without sufficient light. The batteries held up well, and he considers they may be fully relied on for suburban and country lighting. The booklet also contains instructions for setting up and charging batteries.

TRADE NOTES.

The Duncan Lithographing Co., of Hamilton, have recently installed one of The Smart-Eby Machine Co.'s duplex steam pumps in their factory.

The Rock Lake Mining Co. have placed their order with The Smart-Eby Machine Co., of Hamilton, for two centrifugal sizers and three smoke stacks.

Rhodes, Curry & Co., of Amherst, N. S., finding the power plant in their car works too small for their rapidly growing business, are adding a 150 horse power Mumford standard boiler built by the Robb Engineering Co.

The Bruce Copper Mines Co., Limited, have placed their order with The Smart-Eby Machine Co., Limited, of Hamilton, for the followlng: One 150 h. p. Brown engine; one 40 h. p. slide valve engine, with Meyer's adjustable cut-off; one 50 h. p. high speed electric light engine; one two million gallon tandem compound pumping engine, together with all shafting, pulleys, screens, etc., for their concentrating plant.

The American School of Correspondence, Boston, Mass., are sending out a special money card to be used by engineers and others desiring to examine their instruction papers and text books. The card contains a place where a silver twenty-five cent piece may be inserted and securely sealed. This card contains, also, a place for name and address and text book wanted. It may be placed in an envelope and addressed to the school without further trouble. Any one wishing to examine any of the instruction papers of this school should send for one of these cards in order to send the money safely.

The Cataract Power Company, of Hamilton, have found the 25 ton Smart-Eby Company crane which they installed in their power house at DeCew Falls to have been an indispensable tool in handling heavy machinery.

The first annual shareholders' meeting of the Central Ontario Power Company, Limited, proprietors of the Burleigh Falls power, was held on Tuesday last in the Queen's hotel in Toronto, the following officers being elected: President, Hon. R. Harcourt; first vice-president, Eugene Coste, M.E.; second vice-president, James Kendry, M.P.; managing director, J. Alex. Culverwell, electrical engineer of Peterboro and Toronto. The shareholders present and represented were prominent gentlemen from Cobourg, Peterboro, Lindsay, Toronto, Winnipeg, Perth, Iroquois, Galt, St. Catharines, Welland and New York State. Important business was transacted in connection with the commencement of operations. The head offices of the company are located at Peterboro.

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The distribntion is by the three wire system. The voltage on primaries is 1000. Transformers are installed on the banking system, which reduces the voltage from 1000 volts to 104, carried on secondaries. The electrical equipment was supplied by the Canadian General Electric Company, and the engines and boilers by E. Leonard & Sons, of London. The installation was supervised by Mr. T. B. Grady, who is now manager. Mr. H. J. Morrison is the engineer in charge, and the condition of his machinery does him credit. Some 2000 lights are now operated.

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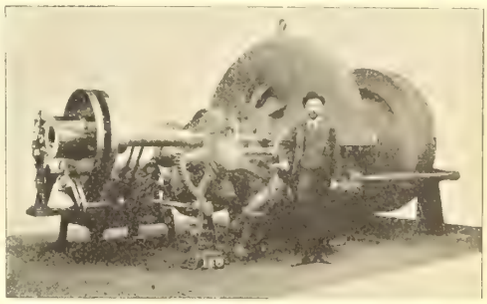
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SPARKS.

An electric light plant may be installed in the village of Bolton, Ont.

A company is about to introduce the electric light into Slocan City, B.C.

The project to build an electric railway from Brighton to Havelock, Ont., is still under consideration.

The residents of Harrow, Ont., are in favor of the establishment of an electric light plant in that village.

The town council of Aylmer, Que., is taking steps to install a fire alarm system.

The directors of the Bell Telephone Company have been authorized to issue $2,500,000 of debenture bonds.

The question of bringing electric power into the town of Calgary, N.W.T., has been brought to the attention of the council.

Mr. A. C. McCollum recently delivered an address before the Peterborough Engineering Club on "The Development of Water Powers."

The Cataract Power Company, of Hamilton, is reported to have ordered forty new street cars for the coming summer's business, for use on radial lines.

The tender of Sadler & Haworth, of Toronto and Montreal, has been accepted for the supply of belting for the electric power house at St. Mary's, Ont.

Joseph Mitchell, of Barton street, Hamilton, is said to have taken legal proceedings against the Cataract Power Company for having strung wires over his house.

Mr James Barnes, M. P. P., of Buctouche, contractor for the construction of the telephone line between St. John and St. Andrews, N. B., states that work will begin in the spring.

The N. L. Piper Railway Supply Company, of Toronto, has obtained a Dominion charter, to manufacture and deal in railway, ship and electric supplies. E. S. Piper, of Toronto, is interested.

The development of the Dickson water power at Peterborough, Ont., is about to be undertaken by the American Cereal Company, in which Senator George A. Cox, of Toronto, is interested.

The Keewatin Power Company and the Lac du Bonnet Power Company are said to have made propositions to transmit electric power to Winnipeg. The distance from Keewatin to Winnipeg is about 130 miles.

At a recent meeting of the Port Hope town council a communication was read from the Peterborough Navigation Company regarding the building of an electric railway between Port Hope and some point on Rice Lake.

The Smart-Eby Machine Company, of Hamilton, have recently installed one of their duplex pumps of 300,000 gallons capacity in the Asylum for Insane, Hamilton, also a set of Rogers patent shaking and dumping grate bars in the Aged Women's Home of that city.

Mr. Potter, of the New Westminster & Burrard Inlet Telephone Company, is looking into the feasibility of the projected telephonic communication between Victoria and Nanaimo. Two routes are proposed, one from English Bay to Nanaimo, via Babriel Island, a distance of twenty-six miles, and the other from Port Roberts to Sydney, via Plumbers' Pass and Salt Lake Island. A special wire will have to be constructed, and the proposed line will cost approximately $100,000.

Some residents of Harvey are talking of building a telephone line from that place to Tweedside and York Mills, N. B. The distance to Tweedside is about eight miles, and a branch line of three miles would reach York Mills.

A committee acting on behalf of the British and Australian Governments has accepted the tender of the Telegraph Construction & Maintenance Company to lay a cable from Vancouver, B. C., to Queensland and New Zealand. It is estimated that the cable will cost £1,795,000, and will be completed by the end of 1902.

It is the intention of the Royal Electric Company, who have disposed of their manufacturing department in Montreal, to engage exclusively in the supply of light and power. It is said that they purpose expending $1,500,000 in improvements to their works at Chambly and in putting wires in the city of Montreal underground. It is estimated that three seasons will be required to complete this latter work.

The London Printing & Lithographing Company have recently placed their order with the Smart-Eby Machine Company, Hamilton, for one set Rogers patent shaking and dumping grate bars. The Muskoka Leather Company, of Bracebridge, have recently installed one of their duplex steam pumps, while the Kinleith Paper Company, of St. Catharines, have recently placed an order with the Smart-Eby Company for a special steel tank.

The superintendent of the Pacific division of the C.P.R. recently conferred with the officers of the West Kootenay Power & Light Company, of Rossland, B. C., in reference to obtaining electric power for the haulage of freight trains between Rossland and Robson. It is the intention to substitute electricity for steam, and it is expected that 2,000 horse power will be required. Between these points there are many steep grades. The Great Northern Railway has under consideration a similar plan for hauling their trains over the Cascade Mountains.

In the important telegraph suit involving the title to the Western Union Telegraph Company's property along the line of the Great Northern railway, a decision was given a few weeks ago in favor of the Western Union. The suit involved several millions of dollars. Its importance, however, was not alone in the amount of money involved, for it was the general understanding that should the railway company have won all the great railway companies of the country would, at the expiration of their contracts with the Western Union Telegraph Company, have claimed the ownership of the telegraph lines along their right of way, and either have operated them independently or have formed a consolidation which would have been a strong competitor in the telegraphic field.

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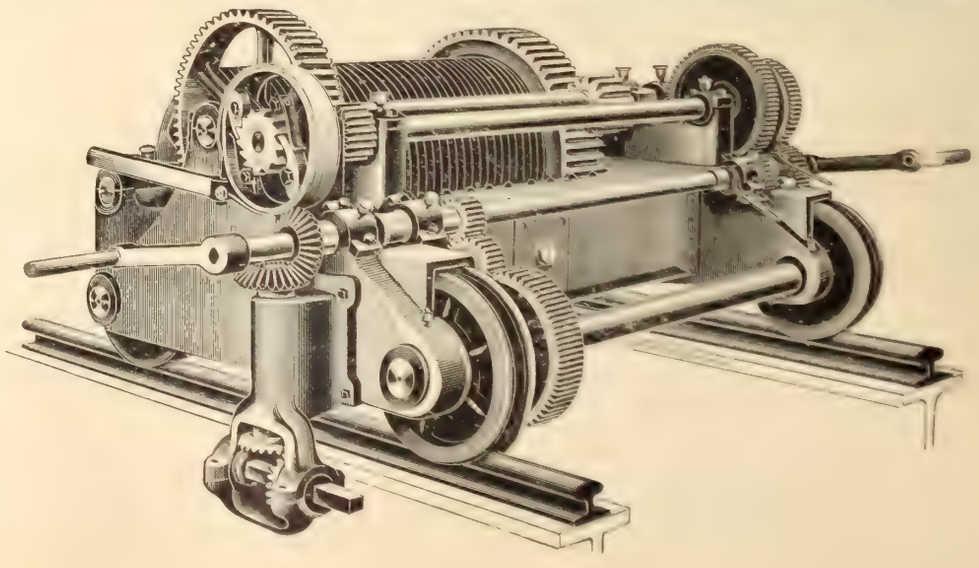
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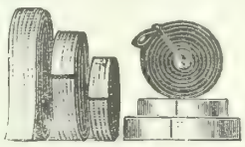
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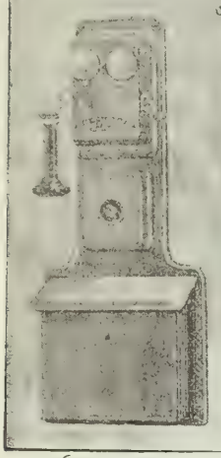
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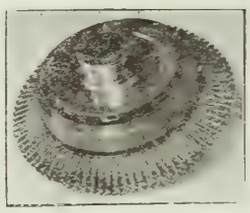
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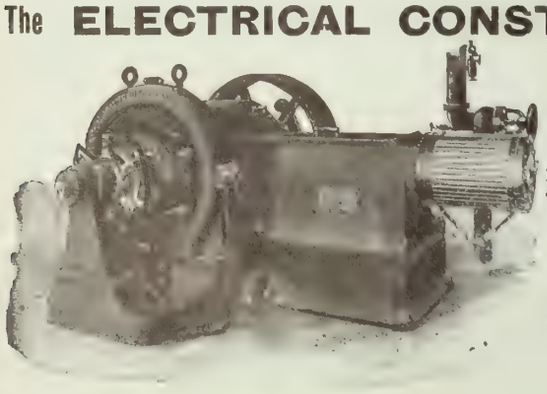
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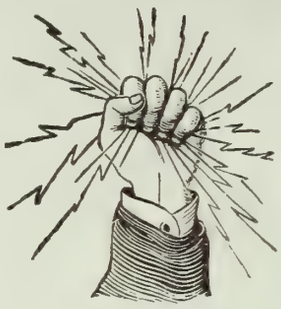
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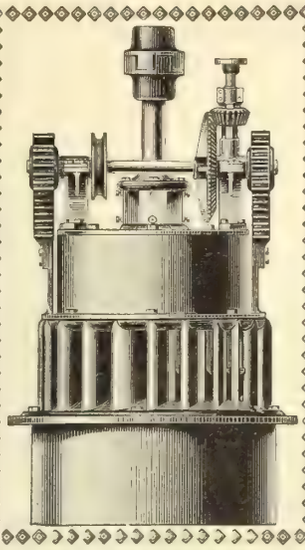
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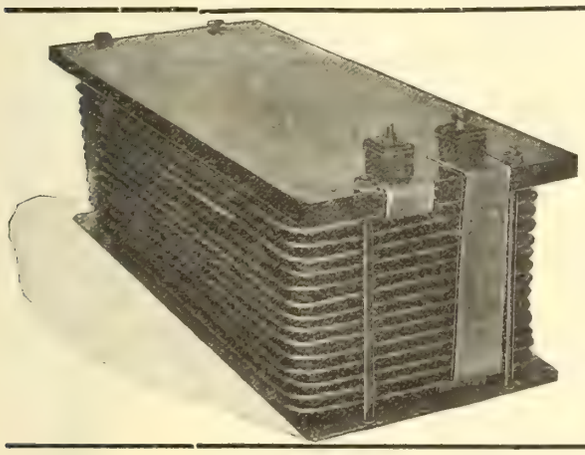
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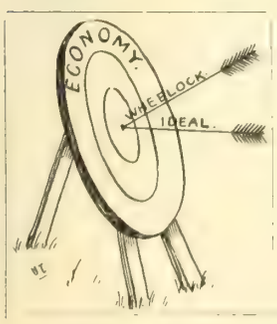
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PERSONAL.

Mr. William Gillespie, of the Ottawa Electric Company's power house, recently joined the ranks of the benedicts, the bride-elect being Miss Armstrong, of South March.

Mr. J. William Morris, B.A. Sc., who has been engaged in electrical engineering in Kingston, Jamaica, and Georgetown, Demerara, for the past two years, has returned to Montreal.

Mr. F. H. Cheney, of St. Catharines, Ont., has resigned as manager of the Niagara, St. Catharines & Toronto Railway Company, and will be succeeded by Mr. Siexas, of New York.

Mr. L. Robinson, who has been manager of the Montreal Park and Island Railway for the past four years, has retired from the company's employ, to accept a lucrative position with the "Compagnie de Traction," of Paris.

Prior to leaving for Toronto, Mr. Ernest I. Jenking, former assistant secretary of the Royal Electric Company, Montreal, was presented by his associates in the company with an address and gold watch, chain and locket.

Mr. R. G. Ward, until recently connected with the Southern Railway, has been appointed manager of construction for The Cuba Company, to succeed the late F. B. Brothers, whose death was referred to in our last issue. Mr. Ward has had an extended experience in railway construction work.

SPARKS.

A western deputation recently interviewed the Dominion Government and requested that a telegraph line be built from Telegraph Creek, B. C., to Skeena.

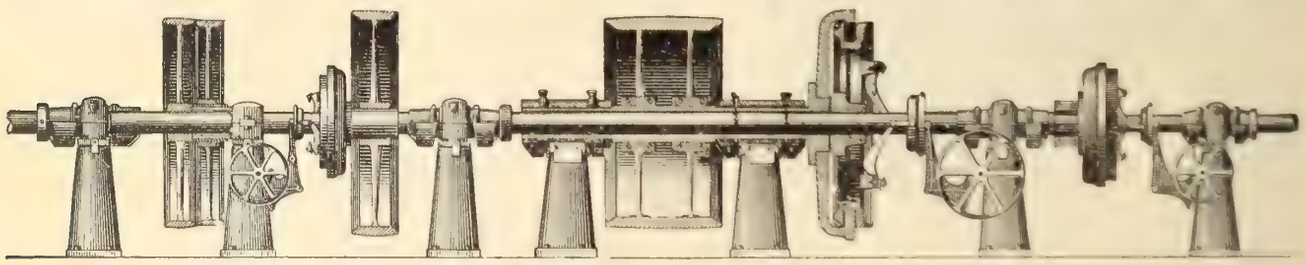
Plans have been completed by Mr. W. J. Carmichael, architect of the Bell Telephone Company, for the new building to be built by the company in St. John, N. B.

The Canadian Association of Stationary Engineers have appointed Messrs. A. M. Wickens and Chas. Moseley as their representatives on the board of management of the Toronto Technical School.

The Dominion Government has decided, in addition to completing the telegraph line from Ashcroft, B. C., north to connect with the Atlin and Yukon country, to build a line 200 miles in length from Port Simpson eastward to Hazleton, where it will connect with the line constructed last year.

Mr. W. J. Poupore has entered an action against the Lachine Rapids Hydraulic & Land Company, of Montreal, to recover the sum of $86,463.93, claimed to be due for work done in the completion of the head and tail races at the company's works at Lachine. According to the declaration, Mr. Poupore tendered to perform certain work set out in the company's plans and specifications for the lump sum of $124,500, of which amount $60,150 was for the extension of the upper wing dam up stream, $64,350 for the extension of the guard pier, the raising of the then existing pier and the raising of the dam. There was a stipulation in the contract, it is claimed, "that should anything be omitted from either the said plans or specifications which would be considered necessary for the completion of the said works, the said contractor should execute the same without obtaining any advantage by such omission, and would supply whatever might be wanting to finish the whole of the works in a complete and perfect state, according to the directions, details and specifications mentioned and referred to in the said contract, save that the contractor would be paid for omissions at the rate specified in the schedule contained in said tender." Because of the alterations in the plans, the changing of the site of the upper wing dam up stream, omissions from plans and specifications for the proper completion of the works, the carrying away by the ice last February of the break-water cribs used in the extension of the dam beyond the 1,000 feet limit agreed upon, and other extras and changes, which are set out in detail, the cost of the work aggregated $222,318.35, or $97,818.35 more than the contract price, and of this amount $135,854.42 has been paid by the company. Considerable interest is centred in the outcome of the suit for the reason that a legal interpretation of what are known as "extras" and "amendments to plans" will be rendered, thus determining questions that for years have been veritable bones of contention in contracting and construction circles.

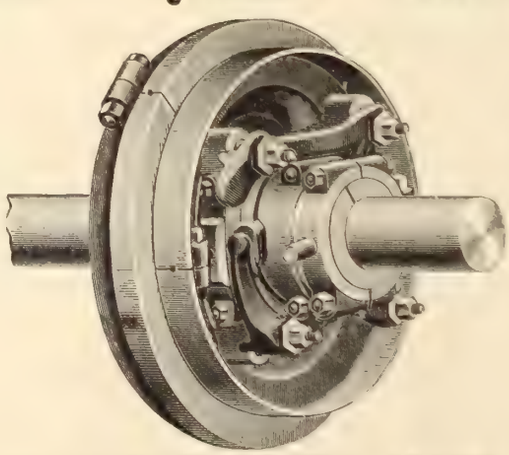
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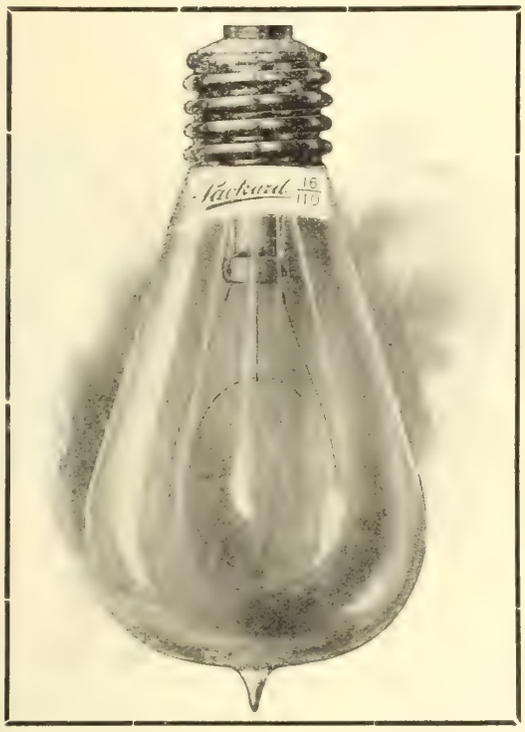
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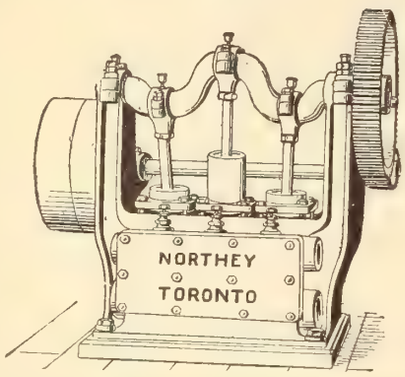
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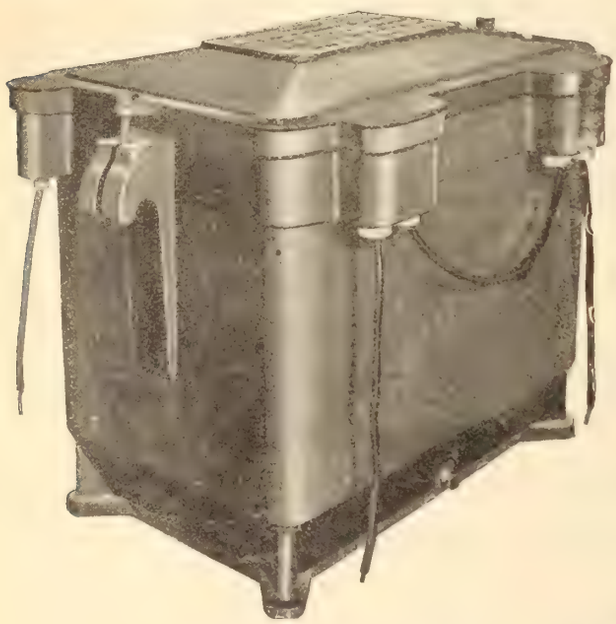


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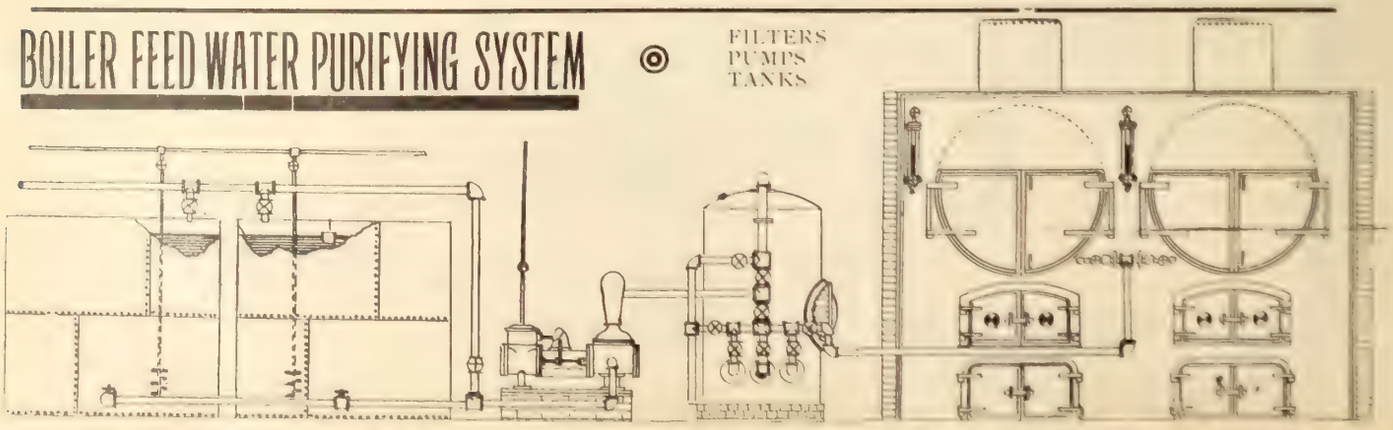
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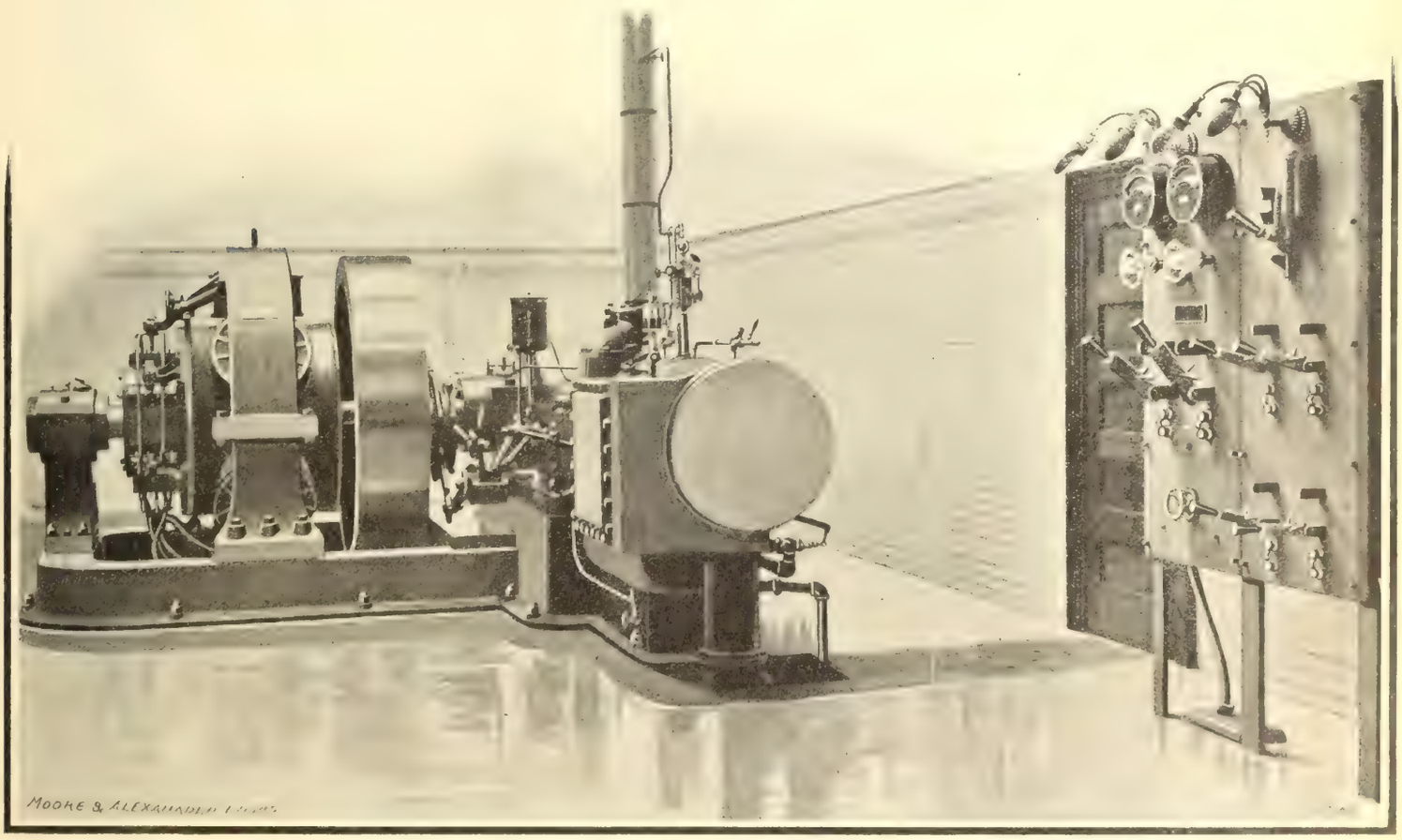
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CANADIAN
ELECTRICAL NEWS
AND
ENGINEERING JOURNAL.

VOL. XI. FEBRUARY, 1901 No. 2.

ELECTRICAL EQUIPMENT OF THE SUNLIGHT SOAP WORKS.

MESSRS. The Lever Bros. Company, Limited, have recently installed at their Sunlight Soap Works, Toronto, an extensive plant for power and lighting. The factory building and offices are most substantial in construction, and taken as a whole, it is probably as well built and complete a factory plant as is to be found in Ontario. Expense has not been spared when the outlay would bring economy in operation and durability of plant. The architects were Messrs. Sproatt & Rolph, Toronto.



ELECTRICAL EQUIPMENT OF THE SUNLIGHT SOAP WORKS, TORONTO. VIEW OF ENGINE, GENERATOR AND SWITCHBOARD.

The steam plant consists of two Hiene boilers made by the Canadian Heine Boiler Company, of Toronto. The engine is a 13″ x 19″ x 16″ stroke, manufactured by the Robb Engineering Company, of Amherst, N. S. Both valves are controlled by the governor ; the relation of cut-off being so adjusted that an equal amount of work is done in each cylinder.

The electric generator, manufactured by the United Electric Co., of Toronto, is a 200 volt, steel 6 pole machine, rated at 125 kilowatts, and operates at 240 revolutions, although capable of an output of 150 kilowatts at its full pressure of 250 volts, Messrs. Lever Bros. having adopted the standard of 200 volts for their installations in England and other countries. This generator supplies current to a dozen motors throughout the works. These are direct connected by couplings or belted to the various machines, not a foot of main or counter shaft being used throughout the works. The motors are the steel multipolar type, enclosed by hinged iron lids to keep out dust.

The arc lamps are of the enclosed type, burning 250 hours with one carbon. The arc and incandescent lamps and motors all take current from the same generator at 200 volts, and the regulation is such that no change in pressure can be noticed in lamps or voltmeter when the heavy motors are thrown on or off.

The switchboard is made of pink Tennessee marble and fitted with Weston instruments and the usual automatic circuit breakers, switches, etc. The office wires are laid in steel conduits.

The United Electric Company, Limited, of Toronto, were the bulk contractors for the generator and engine, and carried out the entire electrical equipment of the works. The generator, motors, switchboard and arc lamps were all manufactured at their Toronto works.

QUESTIONS AND ANSWERS

"Electrician" writes: In reading our wattmeters, which have dials like an ordinary gas meter, I appear to get results ten times too large. Can you advise me in the matter?

Ans.—Your trouble is most likely due to a misconception of the value of the last or right hand dial. For instance, if the amount marked over it is 1,000, it means that one complete revolution of the hand is to be taken as 1,000, not as 10,000, and therefore, if the hand stand over the figure 6, the reading is 600, not 6,000.

A reader asks: What is superheated steam?

Ans.—It is steam heated beyond the temperature at which water at a given pressure turns into steam, this water changing with the pressure, for instance, being 212° Fahr. for the ordinary atmospheric pressure of approximately 14¾ lbs. per square inch, and 327° Fahr. for 100 lbs. pressure.

A station manager asks for a receipt for cleaning the inner globe of enclosed arc lamps.

Ans.—If not allowed to get too dirty a stiff brush made for the purpose, and which can be bought from dealers in electrical supplies, is usually sufficient. If washing is needed, a solution of common washing soda will be found satisfactory for all ordinary purposes, though for very refractory cases you will find that a solution of one part hydro-fluoric acid in nine parts of water will make a perfectly clean globe, though, as it acts by cutting away the glass itself, its use naturally tends to shorten the life of the globe.

"G. S.," Hamilton: What is the object in putting onto the switchboard of an alternator two rheostats, one for its field, and one for the field of the exciter?

Ans.—If the exciter is furnishing nothing but the one alternator, and close voltage adjustment is not necessary, there is no very pressing necessity for the rheostat in series with the alternator field, though, by its means, much finer adjustment of the voltage can be obtained than is possible by means of the exciter rheostat alone. Of course, if the exciter is supplying more than one alternator, or doing other work such as running a few lamps, charging a small storage battery, etc., two rheostats are necessary, because in the first case a change in the exciter field rheostat will produce a corresponding change in both alternators unless individually controllable, each by means of its own rheostat, and in the latter the voltage of the exciter is fixed within comparatively narrow limits by the requirements of such incidental loads, and thus cannot be altered at will as it is desired to change the voltage of the alternator. If it is not necessary to keep the voltage of the exciter at any given point, the alternator field rheostat is usually all cut out, when there is but one machine, and the exciter field is then adjusted, by means of its rheostat, to give the desired alternating pressure.

"Subscriber" writes: I have two direct current compound wound generators, mounted on the engine shafts, and one of them always tries to take more load than the other; we have to move the rheostat all the time to keep the loads anywhere near equal. They are not the same make. What can I do to get over the trouble?

Ans.—The most probable source of the trouble is that the series field shunts are not correctly adjusted. We would suggest that you first try altering these, decreasing the resistance of that on the machine which takes the most load, and if this does not entirely obviate the difficulty we would go into the speed question. It may be that one engine is slowing down much more than the other as the load comes on, or possibly one of them is speeding up as the load rises, or again, it may be that the two machines are operating at speeds varying somewhat from that for which they were designed, which consequently makes the field strengths vary. As a rule, if a machine is running above its rated speed it will tend to take more than its share of the load if in multiple with another running at normal speed.

"R. T.," Montreal: Will you kindly give me the rules for finding the weight of castings by weighing the patterns?

Ans.—Iron castings run, as a rule, about 16 times heavier than the pattern from which they are made; brass about 18 times.

A municipal officer writes: We have a three wire direct current system in our town, and are sometimes troubled by the lights on the outskirts getting very dim, though the power house voltage is if anything higher than usual. Our electrician says that one of the machines reverses. What would you suggest as a remedy?

Ans.—If either generator reverses its polarity, the other one not changing, it means that your system is turned into a two wire plant, and consequently your line drop is very much increased, hence the poor light. The simplest remedy is probably to change the field connections of your generators, so that instead of having the field of each machine excited from its own armature, each is magnetized by the armature of the other generator. When this is done, the reversing of either machine will evidently reverse the other also; so that, though the polarity of the plant as a whole be reversed, it still remains a three wire system.

"Student" asks why the reversing cylinder on a street car controller is made interlocking with the main cylinder?

Ans.—Because if it were not it would obviously be quite possible for the car to be reversed with full power on, or some considerable part of it; this would result in a stop so sudden as to be injurious to both the car and those it was carrying, and also because the reversing cylinder is not made to stand any arcing whatever; consequently, if it were opened while carrying current, it would most probably result in the complete loss of this cylinder and the fingers and wiring round it, due to the fierce arc which would be produced under these circumstances.

Christopher Shale, Smith's Falls, Ont., writes: On the 18th of January, in this town, Dr. Young was found dead in his room, having just come from his bath holding the socket of an electric light in his hand against his breast, which was badly burned. The evidence at the inquest went to show that the current at 110 volts had flowed through his body all night. The system probably being grounded some place, the current flowed

rom the shell of the socket with which one of the wire cables inside was in contact, through his body to his bare foot, which rested on the iron grating surrounding the stove-pipe, that being grounded by the water front in the stove on the flat below. We think that as soon as he stepped on this grating he got the shock and was perhaps stunned in falling, but that if he could have fallen free of these connections the first shock would not have killed him. Do you think it would, or do you think that possibly some outside current leaked in? What number of amperes of current strength are supposed to kill a man? What voltage is required to force those amperes through the body, or what is the average resistance of the human body? I enclose herewith the paper reporting the accident.

Ans.—The amount of current required to kill a man is an exceedingly indefinite quantity and cannot be determined even approximately. There are no two men alike in physical constitution or hygenic condition. Many men are capable of receiving with impunity an electric shock that would kill another instantly. A sudden noise or the shock of receiving bad news have been known to have fatal termination. With such people a very slight shock might have bad results, while others in robust health and strong might stand almost any amount with impunity. Instances are not wanting where strong men have sustained for a short time a shocked backed up by five or six thousand volts E.M.F. A person troubled with organic disease of the heart is supposed to be peculiarly susceptible in the matter of an electric shock, and it may be that in the case you refer to that something of the kind was the cause of the unfortunate fatality.

BY THE WAY.

A Vancouver citizen and a New Westminster man conferred together this morning on the subject of electric lighting bills. New Westminster kicked on an account for close on $5 for his house light for November. "How does this compare with your city?" he asked.

"My bill is never more than $2," said Vancouver.

"Not for the winter months?"

"No, not for any month."

"How many rooms have you in your house in Vancouver?"

"Six, with a light in each."

The Westminster man counted up eight rooms in his house, but only four or five commonly used after dark. He says there is no consumption of light that can be avoided. The light is turned off when not required and as there are only three grown people in the house, the bill should be the minimum.

Yet the New Westminster corporation, boasting that their light is the cheapest in Canada, charge the householders $5 net, while a Vancouver man with about the same establishment gets off with less than $2 a month, his light being supplied by a private corporation.

The absurdity of the local system is illustrated by the bills rendered to The Columbian. The workroom here closes at 6 p. m., and the business office at 6:30. Of late there has been practically no work after those hours; and the total lights in place during November were only twelve, yet the bill from the corporation is $13.43 net. This is on the meter system. In The Columbian block there is a single lamp on the straight rate system, lighting the passage to the offices upstairs. This is never turned off. The charge for the continuous burning of this lamp is 60 cents for the month; while for twelve other lamps, burned only up to 6 or 6:30 o'clock, the charge is $1.12 each.

The oft repeated statement that our electric light under civic management is a great success and the cheapest extant, is evidently only a delusion on the part of the aldermen.—Weekly Columbian, New Westminster, B. C.

* * *

The "dim religious light" shed by wax candles and the sun's rays passing through painted glass, which has been a characteristic of the great churches of Europe, is gradually being supplanted by the electric glow lamp. A recent despatch from Rome states that at New Years Pope Leo witnessed the completion of an electric illuminating system for St. Peter's and the twinkling of innumerable electric lights beneath Michael Angelo's mighty dome.

CAR LIGHTING IN GERMANY.

A recent rear-end collision on a German road which resulted in a violent explosion of gas from the Pintsch illuminating apparatus on one of the injured coaches has caused a renewal of popular interest in electric train lighting. Experiments are now being made on a train between Berlin and Cologne with the Stone system, in which each car carries a small dynamo geared to a wheel axle, and an accumulator, both hung beneath the floor of the car. This system, the American Electrician states, has proved successful in England, but it is said that the varying speed on the Berlin-Cologne line and the stoppages of the train cause variations and unsteadiness in the light, which the accumulator does not successfully correct. Electric lighting has, however, been adopted for the postal cars, of which there are about 3,000 in Germany. A postal car requires for ordinary service the illumination afforded by about 14 ordinary gaslights, which not only consumed rapidly the oxygen in the car, but in summer made the cars too hot for efficient working of the clerks. For this reason, the electric light has become all but universal in the postal cars of Germany, each of which either carries its small dynamo and accumulator, and thus operates independently, or is provided with storage batteries that are charged from an outside source before the car begins its journey. The storage battery used for this purpose is of a type known as the Bose accumulator, four of which, each containing eight cells, carry sufficient energy to supply nine to 11 12-candle incandescent lights during two nights. Consul-general Mason, from whose report these facts are taken, thinks that the electric system will not come into general use for passenger coach lignting in Germany, because of the expense of making the change, which would involve, besides the additional cost of the new outfits, the discarding of a large amount of costly Pintsch apparatus, no part of which could be utilized.

Mr. Wm. Kennedy, C. E., of Montreal, has been engaged by the town of Perth, Ont., to design a power system for the proposed electric light plant.

The Rogers Electric Company, of Toronto, have installed an electric light plant in the McLagan furniture factory in Stratford, Ont. There will be 370 lights. The work was carried out under the supervision of Mr. F. A. Whatmough, local representative of the Rogers Company.

CANADIAN ELECTRICAL NEWS AND ENGINEERING JOURNAL

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EDITOR'S ANNOUNCEMENTS.

Correspondence is invited upon all topics legitimately coming within the scope of this journal

The "Canadian Electrical News" has been appointed the official pape of the Canadian Electrical Association.

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Canadian Electrical Association.

THE Executive Committee has been called to meet at the Windsor Hotel, Montreal, on the 12th inst. At this meeting the programme of the next annual convention, to be held this year in Ottawa, will be considered, and the preliminary arrangements for the meeting will be made. If Parliament should adjourn early, thus placing at the disposal of the Association the required hotel accommodation, the convention will no doubt be held as in previous years, in "leafy June."

Municipal Management.

A GENTLEMAN who has had considerable experience with the management of a municipal lighting plant, while occupying a seat in the municipal council in a Canadian town, expresses the opinion that the only successful method of operating such a plant is by a commission appointed by the council for the purpose. This plan has been adopted in St. John, N. B., and is said to be working out successfully. The gentleman referred to states that every new alderman thinks that he knows more about the management of an electric plant than does the engineer in charge. In pursuance of this belief the aldermen are constantly interfering with the engineer, with the result that his position becomes unbearable and he throws it up. The aldermen on the other hand often hold office for only one year, and so have not the opportunity of acquiring the requisite knowledge to enable them to properly manage this part of the municipal business, so that there is no continuity of management and consequently no profits.

Great Electricians.

THE American Institute of Electrical Engineers recently solicited the opinions of its members as to what names connected with electrical science and invention during the nineteenth century would represent the twenty-five greatest electricians of that period, the names to be placed according to rank. Responses were received from 277 members. A majority of the ballots places Faraday in the first position, Kelvin second, Edison third, Bell fourth, Morse fifth, Henry sixth, and Tesla seventh. A second list was complied from ballots of twenty-five professors of electrical engineering, which places Faraday, Kelvin and Maxwell in the first three positions respectively, but a third list compiled from ballots of twenty-five prominent members of the American Institute of Electrical Engineers gives first position to Faraday, second to Maxwell and third to Kelvin. On the general ballot Faraday received almost twice as many votes as any of the others, showing that in the eyes of American electricians at least, he is regarded as having accomplished most for electrical science.

The Design of Turbines.

THE introduction into Canada of a pair of Italian turbines, and the reasons calling for such action, is of sufficient moment to demand the attention of Canadian water wheel manufacturers and others interested in the development of water powers. An authority on water wheels has stated that the turbines manufactured in Canada compare very favorably with those made in the United States, but are inferior in point of efficiency when compared with the best turbines manufactured in some European countries. It is claimed that the Italian turbines installed by the Cataract Power Company give a higher

efficiency than any of American manufacture, that the cost was no greater, and that stronger guarantees were given. While for the development of water power with average head and flow, the turbines manufactured on the American continent have been found quite satisfactory, it is claimed that they are not so designed as to give the best results in the case of a power with a high head and limited flow of water. In Italy and Switzerland a larger variety of turbines is manufactured, and it has been the object of the turbine builders there to design wheels specially adapted for the peculiar conditions under which they are to operate. The aim of Canadian turbine builders should be to profit by the experience of these older countries, and to bring their manufactures to an equally high state of perfection. This can only be done gradually. It might be to their advantage to send experts to European countries to study the methods and practices of the best turbine builders there.

Electric Traction in London, England.

THE cause of electric traction in Europe is certain to be advanced by the recent decision of the directors of the Metropolitan and Metropolitan District Railway Companies to substitute electricity for steam on their underground system. After delaying the matter as long as possible, these companies have been compelled to recognize the advantages of electric traction. The present decision is claimed to be largely the result of a public demand for the suppression of the annoyances caused by steam locomotives. About four years ago the question was taken up by the Board of Trade, which reported that by far the most satisfactory mode of dealing with the ventilation of the Metropolitan tunnels would be the adoption of electric traction. Another factor which called for the attention of the Metropolitan railway directors was the competition of the Central London Railway, which built the now famous "tube" road, electrically operated, crossing a most important section of the territory covered by the Metropolitan system. The commencement of operations on this road was followed by a decrease in the earnings of the Metropolitan Company. The conversion of the Metropolitan road to electric power is one of the most important undertakings that has ever been proposed. The conditions upon which tenders were invited were purposely of an indefinite character, the object being to permit each tenderer to submit his own plan, and thus to obtain a scheme for the best system of electric traction which modern ingenuity could devise. The contract involves fifty miles of road and an approximate cost of $2,500,000. The awarding of the contract is naturally awaited with much interest. Late advices appear to imply that the proposition submitted by Messrs. Gauz & Company, of Budapesth, has been most favorably considered. As the system proposed by this firm embodies a somewhat novel method of operation, it is intended to have a thorough examination of the system made by the company's engineers, Sir William H. Preece, K.C.B., and Mr. Thomas Parker. Heretofore, it has been the almost universal custom to use direct current for street railway service, since no practical alternating current street car motor was available. But Messrs. Gauz employ the three phase alternating system at the high working pressure of three thousand to five thousand volts. From the central station the wires, charged with a three phase current of 20,000 volts, proceed to converter stations, where the voltage is reduced from three to five thousand volts. It is then conducted to the three-phase motors on the locomotives by a trolley line consisting of two copper wires, the third conductor being the rails. By this arrangement only thin wires are required, thus effecting a great saving in cost of construction. The experimental road at Budapesth was constructed by Messrs. Gauz & Company at their own expense, to demonstrate the simplicity and safety of the system. It has been the subject of much interest to electricians, many of whom have made a personal inspection of it. Besides the firm above referred to, eight other American and European concerns submitted bids for the electrification of the Metropolitan system. They include the Sprague Electric Company, New York; Westinghouse Electric Company, Pittsburg; General Electric Company, Schenectady; Dick, Kerr & Company, London; Mather & Platt, Manchester; Electric Construction Company, Wolverhampton; Siemens & Halske Company, and Schuekert Company, Berlin.

ELECTRICAL MATTERS IN SYDNEY.

(Correspondence of the ELECTRICAL NEWS.)

The Sydney Gas and Electric Company, of Sydney, Cape Breton, have put in a new 175 S.K.C. machine, having now three in operation. The prospects are that another must soon be installed, as large if not larger than the last one. Business has increased 150 per cent., and now power is supplied to several printing offices. The company is under contract with the town for seven years' lighting. If it were not for this, and the fact that another Company is not supposed to be allowed to do business there, an opposition company would be formed very quickly, as the lighting service on the whole has, we understand, been inefficient, and the improvements to the plant have not kept pace with the great demand for light, nor do they seem to have been made with a view to providing for a rapid future extension, which is sure to come immediately. A large new engine from the Robb Engineering Works, of Amherst, was recently added. The present plant is entirely inadequate. Sydney needs a first-class, up-to-date plant, with modern and improved machinery designed purposely to admit of quick extension. All through last January, it is claimed, it was quite a common thing to have the lights go out several times in an evening, and there were break-downs each week. An indignation meeting was finally held, at which a number of the ratepayers took steps towards the formation of a new company which could guarantee an efficient lighting service.

The equipment of the electric plant in North Sydney has also been seriously defective, with results very similar to that of the plant in Sydney. North Sydney is growing rapidly, and the town should have a more modern plant. We understand new machinery will shortly be added.

The Dominion Iron & Steel Company have a fine electric plant, equipped with modern and well designed apparatus. Most of the equipment was supplied by the Canadian General Electric Company. The large ore-bridge derricks and scoops at the stock piles are driven electrically. At the coke ovens an electric push car of the trolley system runs back and forth and pushes the coke forth when heated.

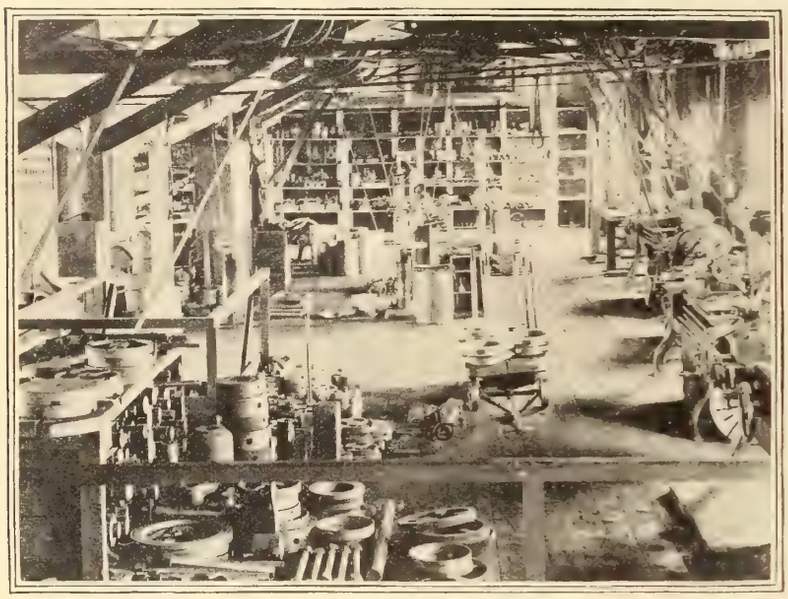
The firm of DeWitt & Mackinlay have opened up a first-class store in Sydney, where they keep a large stock of electrical supplies of all kinds, gas fittings, acetylene gas outfits and general supplies. They opened up there about a year ago, and found a good field, which has developed well and promises even better. Mr. DeWitt is a graduate of Lehigh University, so should thoroughly understand the business. This firm is the only one at present engaged in the business in the town. Among buildings fitted by them are: The new Bank of Montreal, Cape Breton Club, Town Hall, McVery Block, Temperance hotel and many others.

A German professor by the name of Rosenberg has invented a system of wireless telegraphy which he claims is an improvement over that brought out by Marconi. The professor's idea is to reduce the size of his transmitter and receiver so that it may be carried in one's pocket. This would enable a person, so it is claimed, to walk along the street or sit in his office and communicate with his home.

A CANADIAN ENGINE WORKS.

A visit to the works of the Robb Engineering Company at Amherst, N.S., where the well-known Robb-Armstrong engines and Munford boilers are manufactured, was made a short time ago by Mr. Norman Patterson, who contributed an article to the Canadian Magazine giving a brief description of some of the processes of manufacturing engines as practised in these works, together with several interesting illustrations. After a brief historical reference Mr. Patterson says :

First I visited the draughting department, which may be term-



A Canadian Engine Works Corner of the Stock Room.

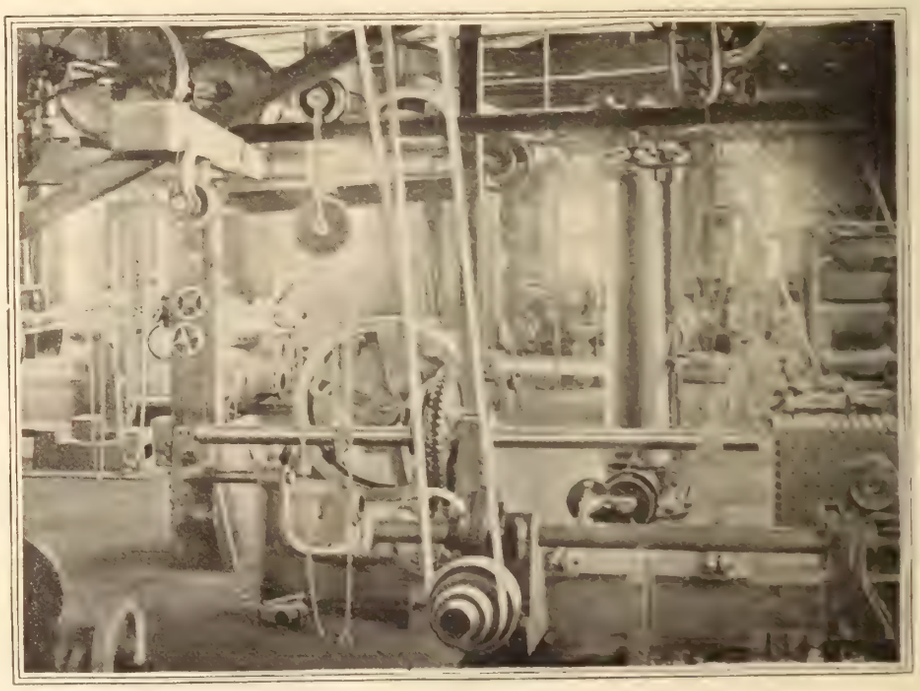
ed the brain of the institution, since it controls and directs the muscular activity of the establishment, and in the large collection of drawings showing every minute part of each engine, we find a counterpart of the human memory. Every bit of knowledge and experience in engine designing and building acquired by this engineering company, as well as that learned and adopted from the work of others since engines were first built, is here stored, the diagramatic and written records being corrected from day to day, as new experience is gained. The draughting department, by means of blue print impressions made from original drawings or tracing linen, directs every man and boy in the establishment what to make and how to make it. Every workman is provided with these small blue print drawings, containing exact directions and minute measurements for the piece he is required to make. These blue prints, after being once used in the shop, are placed in large envelopes with indicator diagrams showing the performance of the engines while working, and other records, and the number and location of the engines built from them. These envelopes are then filed in a large safe as a permanent record of each engine produced.

Proceeding from the draughting department to the machine shops, one is at first confused by a mass of moving machinery, revolving, reciprocating, slow, fast. I stopped before a man who seems to have no use for machinery, but who is industriously scraping a piece of iron with a hand tool. I am told that this man's business is to "make the crooked straight and the rough places plain," the machinist having found that in machinery as in other human affairs there is no such thing as absolute truth, and the nearest approach to "truth" in a flat surface of iron is produced only by the old and slow method of hand scraping. It is interesting to observe the process and the results of this laborious operation. When a piece of iron, such as the steam valve or crosshead of an engine, which has been plained in a machine, is applied to an instrument called a surface plate, the machined surface is found to be all hills and hollows which have to be reduced by repeated scrapings and trials to the surface plate. The surfaces having been brought to comparative truth, it is curious to find that when one piece of iron is laid upon another, the "trued surfaces refuse to come together, the upper one floating on the film of air between them for some time or until the air has had time to escape. But when the air has made its escape, it is so thoroughly excluded from between the "trued" surfaces that the pressure of air on the outside of the plates, which, it will be remembered, is about fifteen pounds to the square inch, holds the plates together so that when the upper is lifted, the lower one follows.

In a similar manner round surfaces, such as journals of engine shafts, are made as true and smooth as possible by grinding with fine emery wheels which revolve at a high rate of speed while the shaft revolves slowly, and by careful burnishing and polishing.

Why, I ask, is it necessary to take so much trouble to get the flat and round surfaces true? Because the wear of machinery is due entirely to want of "truth." When the journals and sliding surfaces are made "true" and kept "true," and if the area of surface is large enough to sustain the weight or strain without squeezing out the oil, the metals will be completely separated by oil, so that they will not touch each other and run smoothly on the oil without wear. But if they are rough or even slightly out of truth, the high places project through the oil, producing friction and wear. As an illustration of this, I was shown some surfaces which had been running together for months or years without wear, as was proven by the marks of the cutting tools being still visible.

In this department I was also shown some illustrations of the minute and accurate measurements necessary in this class of work, when conducted on the interchangeable or duplicate system, by which every similar piece of a machine is required to be exactly alike, within a limit in some cases of one quarter of one thousandth part of an inch. When a pair of straight edges

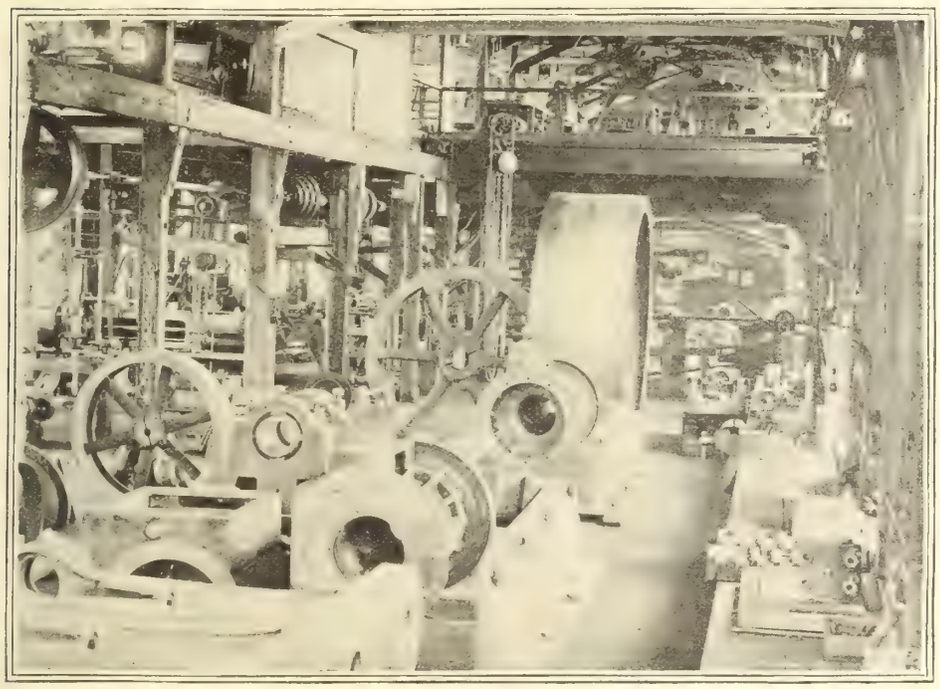


A Canadian Engine Works Portion of the Machine Shop

which, like the surface plates, are of cast iron scraped accurately straight on one edge, are laid together and placed before a window, it is not possible to see a glimmer of light between them, but when a fine hair is laid between them at one end light could be seen about three-quarters of the way along between the straight edges. This hair was then measured by a little instrument called a micrometer calliper, which is ingeniously arranged

to measure thousandths of an inch as easily and more accurately than the ordinary divisions of an inch, eighths or sixteenths, can be measured by the ordinary rule. The hair was shown to measure about two thousandths of an inch, and as I was able to see light about three-quarters of the length of the straight edges, it was evident that the eye is capable of seeing light through a space as small as half a thousandth of an inch. All measurements are made by the standard steel guages, which are warranted by the makers to be correct within one ten thousandth of an inch.

In walking about through the shops I saw many interesting



A Canadian Engine Works Portion of the Erecting Shop.

machines designed especially for manufacturing the engines made here. In almost every case several operations are performed at one time on each machine, so time is saved, and the machined surfaces are made as true as possible with each other without special care or adjustment, as the machines perform this work automatically.

As an example of several operations being performed simultaneously by one machine, I noticed a large machine which had enfolded in its steel embrace a large casting, which seemed to my unaccustomed eyes to constitute nearly the whole of the engine, but which I was told is called the engine frame. This machine was "facing-off" the end of the engine frame to receive the cylinder, boring the guides where the crosshead is to reciprocate and boring the main bearing to receive the crank shaft, these operations all proceeding at once under the care of one workman. Another machine was turning and boring engine wheels or pulleys, three tools being operated at once in this operation, and the hard cast iron was being turned off so rapidly that the chips of iron were hot enough to burn the hand.

After being conducted over the boiler shops, foundry and pattern shop, I finally arrived at the testing department, which contains large foundations arranged for receiving engines of any size, with steam connections to the boilers and condensers, pony breaks for measuring the power, indicators for taking diagrams of the action of steam in the cylinder, tachometers for indicating the changes of speed, apparatus for weighing the steam used by the engine, by means of which it is possible to subject an engine to all variations of work, and to test its speed, regulation, consumption of steam and general performance before it leaves the works. Every engine, large and small, is tested in this way ; working parts are carefully adjusted, valves corrected and indicator diagrams taken, which are filed away with the drawings and other records of every engine that is built.

I was much interested in an explanation of a new system of automatic cut-off and regulation for compound engines, by means of which the steam is distributed and expanded so that under all changes of load, no matter how sudden or variable, the regulation of speed is instantaneous and the work equally divided between the high and low pressure cylinders. This system of governing was developed at first by Mr. E. J. Armstrong, M. E., of New York, who organized the engine department, and has been elaborated and adapted to the present form of the engine by Mr. A. G. Robb, the mechanical superintendent of the works.

It occurred to me that perhaps many of the readers of The Canadian Magazine, like myself, although we read and hear much of compound and triple expansion engines, did not really know what is meant by these terms, and having the advantage of the friendly guidance and instruction of the superintendent of the works, thought it a good opportunity to obtain this information. It was explained thus :

Steam is a gas under pressure, produced from water by heat. The more heat the higher the pressure. Of course, the higher the pressure the greater the amount of work a certain volume of steam is capable of performing.

The study of all engine designers, from Watt down to the present, has been to utilize as much of the pressure of the steam as possible before allowing it to escape. This is accomplished by allowing the steam to expand in driving the piston of an engine. If steam was allowed to fill the cylinder full of high-pressure steam at each stroke, and then escape at full pressure, much work would be lost, whereas, if the steam is only allowed to partly fill the cylinder, or to flow into it during a part of the stroke of the piston, and the supply is then cut off, it will expand, still exerting some pressure and doing work until it expands down to the pressure of the atmosphere into which it escapes.

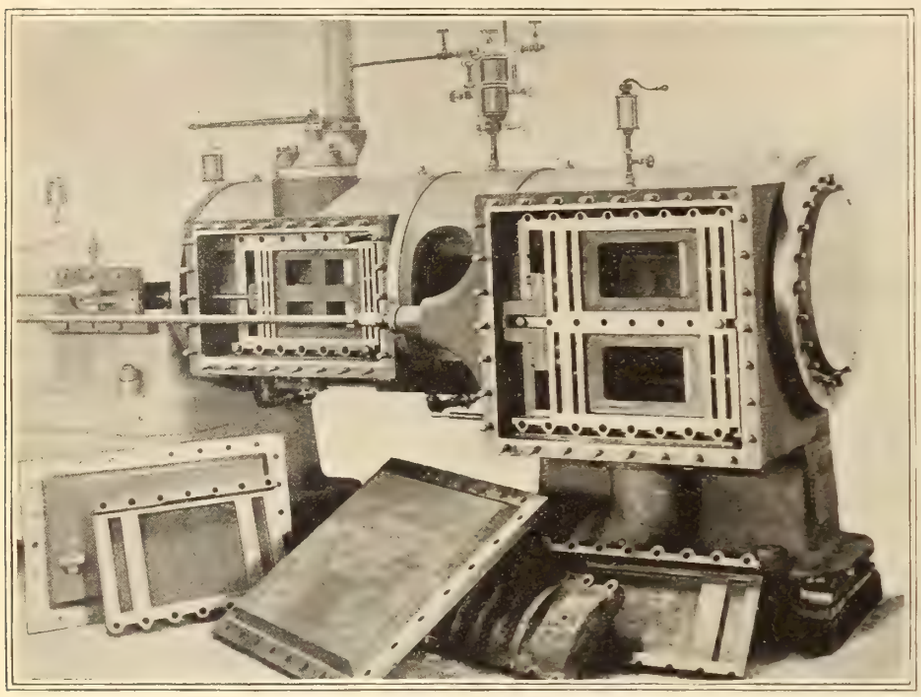
As the art of steam engineering advanced, it was found that the greatest possible economy in the use of steam was obtained by raising the pressure in the steam boiler as high as possible, because it does not require as much heat or fuel in proportion to



A Canadian Engine Works Surface Plates Held Together by Air Pressure.

work done with a high pressure as with a low one, and by getting as much expansion out of the steam as possible ; but further experience and investigation showed that when steam was expanded beyond a certain point in a single cylinder the cooling effect on the interior surfaces of the cylinder was sufficient to almost offset the gain by expansion. For instance, steam at 100 lbs. pressure to the square inch has a temperature of about 338 degrees

Fahr., while the same steam if expanded down to atmospheric pressure has a temperature of only 212 degrees, the same as boiling water. The difference being 126 degrees, or more than the difference in the temperature of the atmosphere on the coldest day of winter and the warmest day of summer, it will readily be seen that when the interior of the cylinder is subjected to this great difference it will have a tendency to cool the hot steam while entering, and to be cooled itself by the expanded steam before it is expelled from the cylinder. In order to overcome this loss, the steam is used in two or more cylinders consecutively, being first expanded partly in one, and then used over and further expanded in another cylinder, so that the variation in temperature in each cylinder is much reduced, and the economy of steam correspondingly improved.



A Canadian Engine Works Cylinders of 300 Horse Power Compound Engine.

A two-cylinder engine, intended for the use of steam at 100 to 125 lbs. pressure, is called compound ; a three cylinder engine, intended for a higher pressure of steam, is called triple expansion ; and so on for higher pressures, until we have quadruple and quintuple engines.

Before taking my leave I enjoyed a brief visit to the model engine-room of the works, where I saw a beautiful, smooth-running engine which drives a large part of the machinery, and which I was told is a duplicate of three engines sent to Barcelona and Madrid, Spain, where they are used for an electric tramway.

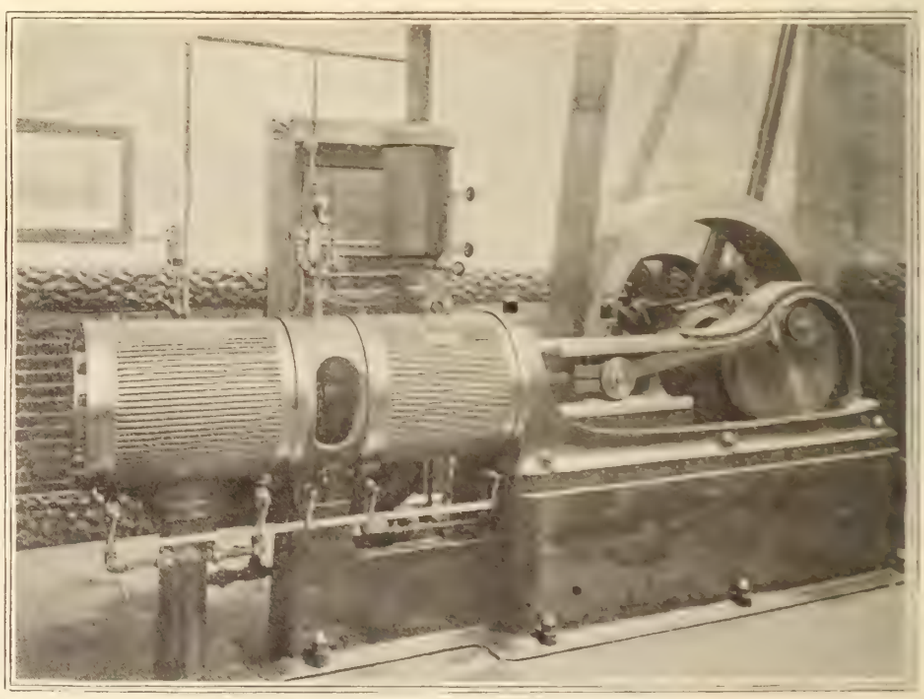
"Lightning-rods seem to be out o date." "Yes, the business was run into the ground long ago."—Philadelphia Evening Bulletin.

An automatic telephone pay station has been tried on board the Hamburg-American line steamship 'Augusta Victoria,' at the pier in Hoboken. All that is necessary to be done to connect the steamer with the telephone system is to insert a plug in its proper place on the desk. This is the work of a second. No attention from the telephone company's employees is required. The connection is made with the Hoboken central office. The system gives passengers leaving for Europe opportunity to transact business up to the very moment of sailing, as it is designed to disconnect the telephone at the same moment the lines are cast off.

A ROARING PHONOGRAPH.

According to the London Daily Mail a phonograph that shouts so loudly that every word can be heard at a distance of ten miles has been tested at Brighton. You can whisper a sentence into the machine's small funnel-shaped mouthpiece and it will repeat it in tones that are more deafening than the shrieks of a liner's steam siren. Yet every word is perfectly articulated, and a shorthand writer ten miles away can take down the message as easily as if you were dictating to him in a small room. The machine is the invention of Mr. Horace L. Short, of Brighton. In appearance it is merely an ordinary phonograph, with a large trumpet measuring 4 feet in length. Inside this trumpet there is a small and delicate piece of mechanism that looks something like a whistle. This is the tongue of the machine. Instead of the 'records' being taken on wax in the usual manner, a sapphre needle is made to cut the dots representing the sound vibrations on a silver cylinder, and when the needle travels over the metal a second time the vibrations cause the whistle to produce a series of air valves, and the machine becomes a talking siren which transforms the human voice into a deafening roar. The experiments were made near the Devil's Dyke, Brighton, where the inventor has his workshops. The instrument was placed on the roof of the laboratory, and was made to repeat a number of sentences. At a distance of ten miles the sounds were plainly heard by a large number of people, every word being perfectly distinct, and at a second trial with a favorable wind it was found that an unknown message could be taken down in shorthand at a distance of twelve miles.

The Indians of the Mohauk reserve are evidently keeping their eye in trim for possible contingencies, judging from the large number of glass insulators broken from their pins on the poles the G. N. W. Telegraph Co., through the Indian reserve. Between Shannonville and Deseronto, a distance of about [illegible] miles, over 400 glasses had to be replaced this week. The cross arms and poles in many places are scarred and marked with stones. The road this summer received a coat of gravel, providing the mischievous with convenient ammunition.



A Canadian Engine Works 125 Horse Power Engine.

A MOVING PLATFORM FOR RAILROAD STATIONS.

A novel device for a moving platform has been suggested by John Perry, president of the English Institution of Electrical Engineers. He proposes to place at each station of the underground road in London a turn-table about 500 feet in diameter. This turn-table is kept continuously revolving at such a rate that its rim travels at the same speed as the moving train. At the centre of the turn-table is a spiral staircase, which, being in the centre, of course, moves more slowly, by which the passenger reaches the main floor. He then walks towards the circumference. The speed at which he is being carried along gradually increases, until at the edge he is travelling at the rate of the moving train, which he here finds seemingly at rest, and with the doors open. He enters, and as the moving platform is left behind the doors are automatically closed until the next station is reached, when they are automatically opened again. With such an arrangement, the track, of course, at each station would be built on a curve closely following that of the turn-table for about half the latter's circumference. Mr. Perry thinks that with this system it might be expedient to have a continuous train on such roads as the underground of London, or the elevated of New York city, so that no matter when a passenger might arrive he would always find a car open and apparently waiting for him.—N. Y. Evening Post.



A Canadian Engine Works Shipment of Engines for England and Australia.

ONE OF THE FIRST AUTOMOBILES.

Quebec, Jan. 10, 1901.

Editor Canadian Electrical News:

Dear Sir,—In looking again at yours of the 3rd inst., in relation to my paper on "The Progress of the 19th Century," I find that you are kind enough to say that you were interested to learn that I was one of the original inventors of the steam vehicle, and would be pleased if I would give a more detailed description of the apparatus. You go on to add that in view of the recent development in this direction, a description and illustration of my invention would be interesting.

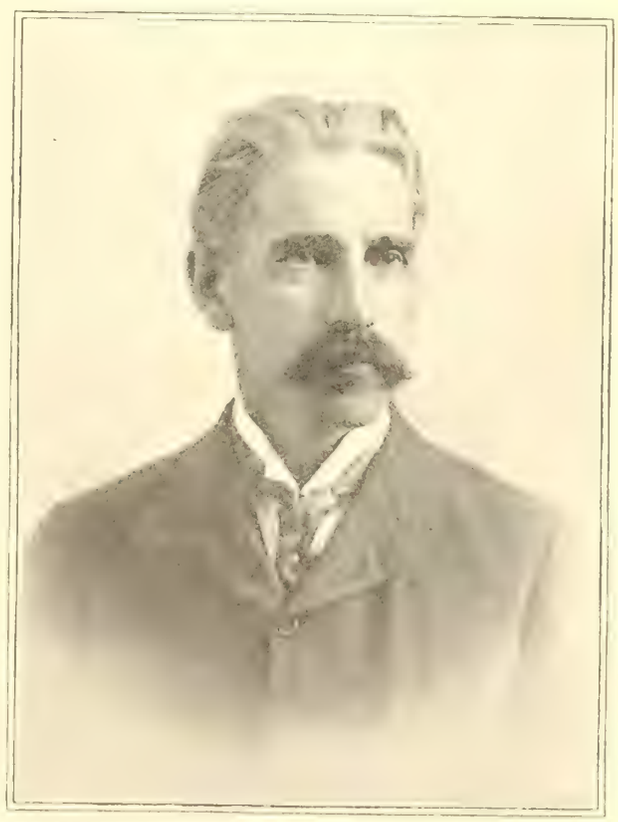
Now, Sir, I have at the present time but a feint remembrance of Trevethick's steam coach for common roads, and I suppose you would like to know in what I declare my vehicle to be an improved one compared to his. It is this, if I remember well, that while Trevethick's motor was a single engined one without a fly-wheel to get it over the "dead points" when it happened at an impediment in the roadway, my machine was a double cylindered one, whereby, the cranks on the axle being at 90 apart, the dead points were got over by one of the pistons being only half way on its travels, while the other was at the turning point and thus capable of exerting a force necessary to overcome any inequality in the paving or macadam. The twin engines were of the ordinary "working beam" type, with parellel bars at one end engaging the cross-head of the piston rod working in guides as usual, while a connecting rod at the opposite end of the oscillating or working beam engaged the crank on the axle or shaft of the vehicle on which the wheels of the automotor were mounted, while a third wheel of less diameter, and capable of running in under the carriage to which it was attached by a bar twining or a swievel, was used to steer the waggon and turn it when required end for end in a radius of a very few feet.

This vehicle, as stated, I built in 1844, working at it after hours and on holidays, as I was then a pupil at the Quebec Seminary. I was helped at it by another boy, one Federick Holt, since burnt at the fire of an old Quebec theatre, and whose father, a German, was for several years organist of the French Cathedral, now the Basilica, Quebec.

It may be foolish now to say so, but I was ever so much pleased when on letting steam into the cylinders for the first time, I found I had placed the eccentrics so exactly as not to require their position to be altered in the least to admit and cut off steam at the absolute moment of time necessary to prevent any loss of power whatever by back pressure.

The two engines were built entirely by ourselves, including the drilling of every hole and the making of every screw, bolt and nut in the whole concern; while all we got done by outsiders were the boiler, a horizontal one some 2 feet in diameter and 3 feet long with a 15 inch fire flue within it, and the three wheels, which we had made by a regular wheel-wright.

The cylinders were, I believe, about 3 in. inside diameter or less, and some 8 in. to 9 in. long, the pair developing under steam at 30 lbs. pressure about one horse power or more, which drove us along the road at from 8 to 9 miles per hour, the weight upon the driving or bearing wheels being hardly more than 1,200 to 1,500 pounds all told, or with from 2 to 4 persons in the vehicle. I need hardly add that, of course, it was in no way comparable to the automobiles of the present day.



Mr. D. W. Robb

President and General Manager Robb Engineering Company

ELECTRIC RAILWAY DEPARTMENT.

ELECTRIC RAILWAY IN NEWFOUNDLAND.

By R. F. Markill.

Newfoundland abounds with small and large fresh-water ponds, many of which are so situated that, with very little expense, they can be turned into valuable sources of power. About eight miles from St. Johns, high in the hills which form the rugged coast line of the island, are a number of these ponds, emptying into



Fig. 1. Power House, Showing Iron Pipe Line from Wooden Flume.

the sea at a small fishing village called Petty Harbor, and here it is that Mr. R. G. Reid, of Montreal, the great land proprietor and railway magnate of the island, has built the power-house for the electric transmission plant that, on May 1, 1900, began to supply energy for the operation of the first electric railway system in St. Johns —the system of the "St. Johns Electric Railway."

At present only two lakes have been dammed, one having an area of 25,000,000 square feet and the other 1,000,000 square feet, making a total of 26,000,000 square feet. Besides these two reservoirs now in use, there are two others within close proximity having areas of 9,000,000 and 31,000,000 square feet, respectively. A dam and gate are at the mouth of the larger lake to regulate the flow of water, as is required, so that there may be no waste.

From the mouth of the smaller lake a wooden flume 3468 feet in length, carried along the side of the hill, conducts the water to a point 187 feet above the power-house. It is constructed of native spruce 8 ft. x 8 ft. framed timbers on 3 ft. centers, planked on the bottom with 2½ inch and sides 2 inch. The flume practically ends in a rock tunnel 368 feet long, cemented at the junction. Not any lining is used inside, the rock being sufficiently water tight. At the other end are located the pen-stock and gate. From here a pipe 318 feet long, 6 feet 6 inches in diameter, brings the water into the power-house below. This pipe is made of steel plates ⅝ of an inch thick, anchored to concrete pillars, twenty-two in number, embedded in solid rock. Two anchor bolts five feet long, riveted to the sides of the pipe, run through the basin and are bolted to timbers at the back.

The generating station is 138 feet long by 24 feet wide, constructed of native blue stone, with wooden roof covered with sheet iron, cemented floor, and well lighted by large windows. At present only two generators and one water-wheel are installed, but everything is ready for placing another wheel of the same capacity and also two more electrical units. The wheel is of the turbine type, having a rated capacity of 1868 horse power when operating under a head of 187 feet. The wheel is regulated by an electrical governor. On the shaft is a nine-ton fly-wheel, made up of sheet steel plates, bolted together and turned in a lathe. Two Westinghouse generators are directly connected to the water-wheel, one on either side. They are rated at 600 kilowatts each, revolving armature, three-phase type, running at 237 revolutions per minute, and delivering 500 volts at 60 periods per second. Two exciters furnish the field current for generators and lights for the station. They are directly connected to a 50 horse-power turbine, one on either side of the wheel, arranged in the same manner as generators. They have a capacity of 15 kilowatts each, four pole, 110 volts, 605 revolutions per minute. An interior view of power house is shown in Fig. 2.

The switch-board is the ordinary Westinghouse type, consisting of four white marble panels, two for the generators and two for the exciters, with the usual number of ammeters, Niagara-type wattmeters, voltmeters and a Mershon compensator for loss on the line. The current is conducted from the switchboard to the primary side of the step-up transformers on twelve 500,000 circular mil lead-covered tables. On each transformer is mounted a Westinghouse 500-ampere quick break switch for the purpose of opening the primary side if necessary. Three Westinghouse transformers of 400 kilowatts each, oil cooled, raise the voltage to 15,000 volts for transmission. They are connected in delta. From the secondary side the current goes through six high tension pole switches and circuit

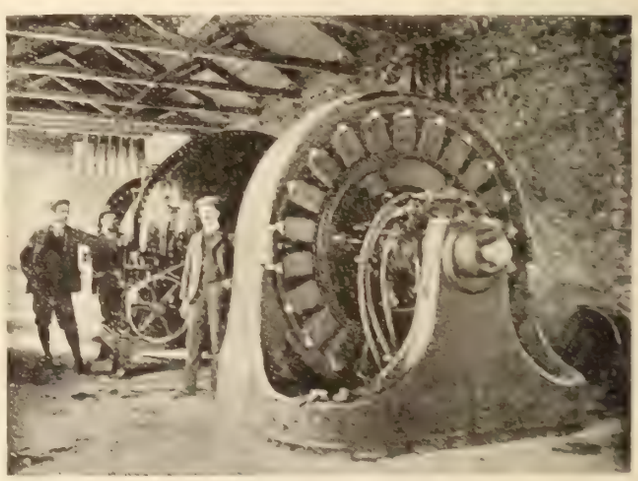


Fig. 2. Interior of Power House.

breakers to the bus-bars and thence to the pole switches connected to the line circuits. The Worts lightning arrester is used. These are installed in loft at the end of the building over the high-tension switches.

POLE LINE.

Current is brought into St. Johns over two pole lines, in order to insure against interruption of the service. The poles are about 125 feet apart; three wires of No. 5 B. & S. medium drawn on each line, Locke three petticoat glass insulators and locust wood pins, boiled

in paraffine wax, are used, as they are believed to give best results where there is so much fog and rain. There is one cross-arm on each pole, with a pin at either end and a pin in the top of the pole, thus forming an equilateral triangle. The wires are not spiraled. A telephone line connects the generating station with the sub-station, wires being transposed every four poles.

The sub-station (Fig. 3) is at the west end of the city, just beside the dry dock. In appearance it very much resembles the power-house, being constructed of the same material and having a concrete floor, etc. The dimensions are 90 feet long by 30 feet wide. Line wires enter the end of the building through high-tension pole switches similar to the one in generating station, thence to the high-tension bus-bars and distributing switches to four 100-kilowatt Westinghouse oil-cooled transformers for two rotary converters. The transformers are connected Scott system, giving a two phase current at 400 volts. The sub-station also contains four 150 kilowatt transformers, giving two-phase currents at 2040 volts, used for city circuits. The high-tension switches are pole-switches with fuses, each having a marble slab with an air gap of 3 inches between slabs and a shield of asbestos 38 inches by 30 inches. Two

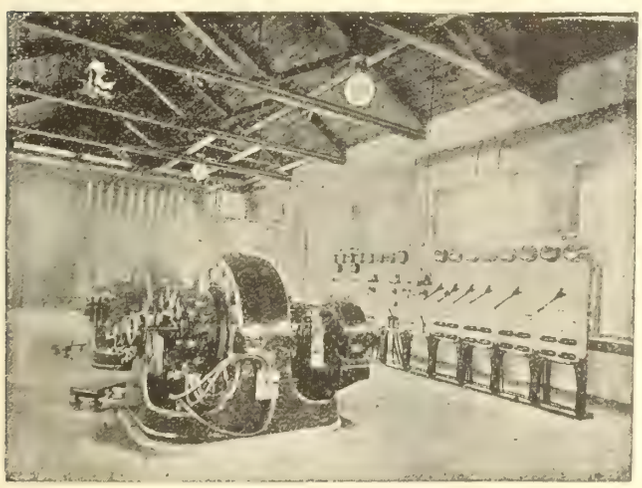


FIG. 3. INTERIOR OF SUB-STATION.

rotary converters are at present installed, but foundations are ready for two more. These converters are rated at 200 kilowatts each, speed 720 revolutions, and 500 volts for street railway circuits. The switch-board is of white marble, nine panels in all, four of which are used for the rotary converters and one for railway feeders, the remaining four for light and power, two panels for each. All station appliances are of standard Westinghouse types of latest forms. The remaining interesting feature of the sub-station is that the Manhattan series alternating enclosed arc system will be installed immediately for the street lighting. This will necessitate the addition of one more panel to the switchboard.

The rolling stock of the St. Johns Electric Railway consists of six cars, 32 feet long, equipped with Westinghouse "12a" 30 horsepower, series-parallel, 38 controllers. Four of the cars are double-enders. Two sweepers are provided for the winter season. The track is narrow gauge, to be in keeping with the Newfoundland Railway, which has a gauge of 3 feet 6 inches. Five miles of 50-lb. T. rails have been laid and cars are running over them every day; also, 5700 feet of 83-lb. girder rails on the principal street, which at present is being paved. The trolley wire is No. 0 and suspended from poles on either side of the street. Rails are bonded in the usual way and cross-bonded every 400 feet, No. 0 bonds used for 50-lb. rails and 00 for 83-lb. A number of very steep grades are encountered, one short grade of 14 per cent. and several of 7 and 8 per cent. Two or three curves of 45-ft. radius are also met with. As can be imagined, the cars, motors and trucks have had a severe test, but notwithstanding that they have stood it admirably. The cars and trucks were made in Montreal, the former by the Lariviere Car Manufacturing Company and the latter by the Montreal Switch Company.

The city has a population of 35,000 people, of which the majority are interested in the fishing industry. Quite a lot of manufacturing is done, and as coal is very expensive there is a good demand for electric power.

Mr. C. H. Massy is consulting engineer, Mr. W. A. McKay is superintendent and electrical engineer, and Mr. F. H. Wing is electrical engineer in charge of the generating station at Petty Harbor; while Mr. R. F. Markill is in charge of the sub-station. To these gentlemen is due the credit of the building and operation of this highly successful installation.—Journal of Electricity and Gas.

LIVERPOOL MARINE ELECTRIC RAILWAY.

There has recently been installed in Liverpool, Nova Scotia, an electric marine railway of quite a novel character. The electrical equipment was supplied by the Royal Electric Company, of Montreal, and was installed by the Maritime Electric Co., of Halifax N. S.

The equipment consists of a 30 h. p. induction motor, the motor shaft being geared to a heavy worm shaft and wheel; the worm wheel shaft carries a pinion wheel which gears into another large wheel, on the shaft of which is placed a large heavy sprocket wheel; over this sprocket wheel the heavy two inch chain meshes into heavy sprocket teeth. This chain hauls the vessel up on a cradle over a track projecting out into the River Mersey to a distance of 500 feet, on a grade of ½ inch to the foot. The track and cradle are built in a very solid and substantial manner, being constructed of heavy pine timbers. The concrete foundations and heavy hardwood gear frame, as also the track and cradle, were built and erected by Mr. A. W. Bowcher, contractor, in Liverpool, N.S., and the work is certainly a creditable piece of construction.

Mr. G. C. Siebert, manager of the Maritime Electric Co., spent two weeks in Liverpool installing the plant, and on Friday, January 11th. the first vessel was hauled up and lowered down again, all the apparatus and gear working in an entirely satisfactory manner.

It is interesting to note that Liverpool possessed the first marine railway in the Maritime Provinces, the motive power used being horses. It formerly took from 4 to 5 hours to haul up a vessel, whereas the same work is now performed in 20 minutes. It is also interesting to note that this railway is, without doubt, the first one in America and probably the first one of its kind in the world to which electrical energy has been applied as the motive power.

The installation has been watched with the keenest interest by those connected with Maritime affairs, all of whom have expressed themselves as being highly pleased with the installation.

As a general proposition, advertising pays. There are qualifying considerations. It must be good. Advtsor.

MONTREAL

Branch office of the CANADIAN ELECTRICAL NEWS,
Imperial Building,

MONTREAL, February 7th, 1901.

A couple of items in the daily press lately are worthy of note: 1st, the notice of a trolley wire having fallen on a team and teamster, the former being killed, but the latter being "protected" by his wet clothes, which the paper informs us, acted as an insulator. 2nd, another daily voicing its views on the late destructive fire at Thos. May & Company's, says: "It will probably never be known what caused the fire, but no doubt it was due to electric wires." (When in doubt, blame electricity.)

It is possible, but highly improbable, that the late fire in Thos. May & Company's was electrical. The fire, it is admitted, started about 10 p.m. Now, the establishment in question closed at 6 p.m., and it is rather unlikely that it should smother until then, especially as the factory portion of the establishment has considerable wooden benching, partitions, etc. Again, if the office clerks were back after hours they would have used gas, as the electric light installation was not extended to the ground floor. So far as the motor circuit is concerned (250 V. D.C.), the wires entered by a window, on top floor and the interior circuit ran only about 12 feet to where the motor was located, same being duly provided with a D.P. J.K. switch. The electric lighting outfit was limited in its area, and was "open cleat" style, and not of an ancient type. The chances are far stronger that the fire can be laid down about the sewing machines (run from shaft) under bench, as actually was the case in the former Bernier & West fire; the daily news putting it to electricity, notwithstanding proof.

The Royal Electric Company suffered most severely in the late May fire, one of their principle pole lines full of various circuits coming up McGill street having been cut. The Montreal Street Railway came next, having to direct their traffic from the busy Windsor route. The water covered their tracks inches deep with solid ice, which later took a small army to clean. The Bell Telephone Company also had an aerial cable cut. The Royal Company only suffered very slight detention, as their line-men, in spite of the severe cold weather, were busy as bees.

Your correspondent is informed that Mr. Walter Grose, hardware merchant, of Montreal, contemplates shortly turning out incandescent lamps from the factory in Hamilton in which he is interested. The Shelby pattern of lamp is to be the type produced, and it is claimed that machinery is now all delivered.

It has not yet been stated that the $3,500,000 fire was caused by electric wires. Why? It started in premises of Saxe & Co., it is said, and he had a hoist motor and some lights. True, they can prove their main switch near inlet to have been opened, but a trifle like this should not stop some ubiquitous "daily." Also, where the missing employees worked on top flat, gas was the illuminant. Another case where the actual cause will be hard to discover on account of the extreme wreck; some may say electric, but think it will be as hard to prove as many a similar puzzle. Quite a lot of valuable electrical installations and apparatus were lost in this fire, particularly the plant in the Board of Trade building, with its Edison bi-polar 110 V. dynamos, switchboard, etc. The building was wired in brass-armored conduit.

NEW INDUSTRY FOR HAMILTON.

The Ontario Lantern Company, of Hamilton, have recently added to their extensive manufactory a most modern plant for making incandescent lamps, and they have acquired the Canadian patents for the celebrated Shelby lamp, with double coil horizontal filament, and will manufacture the same in the varied sizes and efficiencies required.

They have associated with them Professor Chaillet, of Buffalo, one of the best electrical experts on this continent, and the lamps that are being made in Hamilton are likely to attain the high reputation enjoyed by the American Shelby Company.

The consumption of lamps is increasing rapidly throughout the Dominion, and we have no doubt that there will be a good demand for radiant Shelby lamps.

Mr. Walter Grose, of Montreal, is largely interested in this company, and is sole selling agent for the different lines of lamps, lanterns, etc., which they manufacture.

TELEGRAPH and TELEPHONE

CHAS. P. DWIGHT.

THE news of the death on January 20th of Mr. Chas. P. Dwight, assistant general manager of the Great North-Western Telegraph Company, came as a painful surprise to his many acquaintances and friends, the majority of whom were not aware of his illness, which lasted only five days. Mr. Dwight was attacked by a severe cold, which rapidly developed into acute pneumonia, to which, despite the efforts of the most skillful physicians, he succumbed.

Mr. Dwight was a native of Toronto, and was only twenty-nine years of age. He received his education at Upper Canada College, and Sorel College, Quebec. In 1891 he joined the Northwest Mounted Police, and served a year with that body. During this period he collected the material for a little book entitled "Life in The Northwest Mounted Police, and Other Sketches," which he prepared and published the following year,



THE LATE CHAS. P. DWIGHT.

and which evoked much favorable comment and had quite an extensive sale. He subsequently contributed cleverly written storiettes to various American publications, as well as to the press of his native city. In 1895 he prepared for the Canadian Electrical Association, of which he was a highly esteemed member, a carefully written historical paper on "The Telegraph in Canada." In 1892 Mr. Dwight entered the office of his father, Mr. H. P. Dwight, president and general manager of the G.N.W. Telegraph Company, where, by close application to his duties, combined with business ability of a high order, he earned advancement to the responsible position which he occupied when so suddenly called away.

The presence at the funeral of many employees of the company, and of floral designs from the various departments, evidenced the general esteem in which the deceased was held by his business associates, five of whom acted as pall-bearers, viz.: Messrs. A. B. Smith, G. D. Perry, A. Cox, George Hogarth, W. B. Powell and W. J. Duckworth.

Mr. H. P. Dwight and his family have the sincere sympathy of their many friends in the great loss which they have sustained.

ENGINEERING and MECHANICS

CANADIAN ASSOCIATION OF STATIONARY ENGINEERS.

Mr. A. M. Wickens, executive secretary of the Canadian Association of Stationary Engineers, reports that about two months ago a branch association was started at Sarnia, Ont., with thirty-four charter members, and prospects for a most successful association. Mr. Walter D. Hall is secretary.

The half-yearly returns from the various lodges are coming in promptly and show an increased membership. Vancouver No. 19 intend making a strong effort at the forthcoming session of the British Columbia Legislature to secure a license law.

Toronto No. 1 will hold their annual At Home in the Confederation Life Building on Thursday, February 14th. The committee are working earnestly to make it a success. At a recent meeting of the association a most interesting talk on electricity was given by Mr. E. J. Philip.

The executive secretary has received advice from Brantford that the engineers there are already preparing for the August convention.

ARTIFICIAL FUEL.

Advices from abroad state that the British Admiralty is about to arrange for a series of trials of artificial fuel, the two varieties being Welsh bituminous coal residuum bound with pitch or tar, and the other a mixture of anthracite coal and highly bituminous matters with tar made up into blocks of 22 pounds each. A separate series of trials are to be made at different speeds, and with both natural draught and forced draught. There is a great disadvantage, however, in both kinds of fuel over ordinary anthracite coal, namely, that they produce intense volumes of black smoke. Ordinary anthracite is smokeless, but has the disadvantage that no one has hitherto been able to form it into briquettes. A process has, however, now been worked out at Swansea, England, for making anthracite briquettes with the admixture of bituminous coal and the like, and a plant is about to be put down for turning out half a million tons a year.

STEAM HIGH OR LOW PRESSURE?

When water is heated to the boiling point, the temperature remains stationary, and all subsequent additions of heat become latent, or unapparent, and are carried off in the form of steam. If a given weight of water be evaporated into steam in a perfectly steam tight boiler, says The Engineer, the weight of steam produced will be exactly the same as that of the water from which it was produced, that is, one pound of water will generate exactly one pound of steam.

One pound of water at a temperature of 212 degrees F., in passing into steam of the same temperature, absorbs as much heat as would have raised the temperature of the water 966 degrees, if it had not boiled and the heat become latent. Therefore, a unit of evaporation is the evaporation of one pound of water at a temperature of 212 degrees into steam of the same temperature, and is equal in round numbers to 966 thermal units. The heat required to raise one pound of water from zero to 212 degrees and evaporate it into steam of the same temperature is equal to 966 plus 212, or 1178 heat units. The quantity of heat required to evaporate a given quantity of water in a boiler depends upon the temperature of the feed water, for of course the more heat that is put into the feed water the less will be required in the boiler. If the temperature at which the water is supplied to the boiler be represented by t, then the total heat required to evaporate one pound of water from and at 212 degrees is, $1178 - t$. If the temperature of the feed water is sixty degrees, then the total heat per pound is $1178 - 60 = 1118$ heat units.

The quantity of heat required to generate steam increases slightly with the pressure, but the increment, or rate of increase, is so small that, for practical purposes, it may be assumed to be the same for all ordinary pressures. Hence the cost of fuel for generating steam is practically the same for high pressure steam as for low pressure steam.

The rate of evaporation, however, varies directly with the rate of combustion of fuel, that is, other things being equal, doubling the rate of fuel consumption doubles the rate of evaporation.

The total heat of steam increases with the temperature at the rate of .305 of a thermal unit for each degree of temperature above 212 degrees. The total heat of one pound of steam at 212 degrees is 1178 units measured from zero, and the total heat of steam at any other temperature may be found by adding .305 times the difference between the given temperature and 212, to 1178. The temperature of steam of 100 pounds pressure is 337.7 degrees, and the total heat of one pound is $1178 + (337.7 - 212) \times .305 = 1216$ heat units, or $1216 - 32 = 1184$ heat units, fractions omitted, above 32 degrees.

ENGINEERING NOTES.

When starting up a new engine, the boiler pressure should be kept low and only a light load put on for a few days, until the parts that constitute the rubbing and revolving surfaces show no tendency to heat or cut.

Newly packed joints should be carefully watched, and as soon as they are thoroughly warmed up, and before pressure is put upon them, the nuts should be tightened again, as some kinds of packing become soft under the action of heat.

Visitors to your engine room do not stop to find out how much you are paid for running the engine that you have charge of, therefore do your work well even if you are not paid as much as you think the job is worth, for you will be judged according to your work and not by your pay.

When an engineer takes charge of an engine that he is not familiar with, he should not screw up the nuts on the piston-rod gland until he knows what kind of packing is in the box, for some metallic packings are wedge shaped, and the rod may easily be injured by screwing the nuts up too tight.

Drying Core Disks. When the disks are on and ready for drying the electrical mechanic must look after the air. It is not enough to have plenty of hot air to dry the core, for often it is found that, after all, the parts refuse to dry, even with a plentiful supply of hot air. This is due to the fact that the air has become saturated with moisture, and if this moist air is not given a chance to get out of the drying box, the parts will not dry. Therefore, one should see to it that the air has a chance to get out as well as in, and then there will be no trouble.

Mr. A. Reis, of Antwerp, has patented the following method for preventing incrustation in boilers: A mixture of sugar, tannin extract, silicate of potash or soda, and boric acid is added to the boiler water to keep the salts in solution. When the water attains a density of about 15 Be to 25 Be, the boiler is "blown off." The working periods range from a fortnight to three months, according to the quality of the water in use. Glycerine and alkaline sulphates are sometimes used in mixture. How much of the latter is required per gallon is not stated.

At the last meeting of the American Society of Mechanical Engineers, Chas. T. Porter, in his discussion of Dr. Thurston's paper on "The Steam Engine at the close of the Ninteenth Century," stated that it is a principle of the new engineering that "the boiler furnace shall be independent of natural draft, effectually consuming its smoke, and burning two or more times as much coal per square foot of grate as it could do under natural draft alone, and yet sending off the gases at a low temperature; the boiler being a steam generator, a superheater and fuel economizer combined." This statement clearly shows Mr. Porter's faith in the future of mechanical draft as a substitute for chimney draft as a means of securing the desired ends.

Oiling Machines.—It is worth while to take space to say a few words as to the oiling of those parts of the core shaft that are liable to heat. It should always be remembered that careful oiling means a saving of oil, but this is not the only benefit derived therefrom. The usual practice is for the operators of machines to oil up before starting, by taking an oil can on which the spout has been enlarged so as to emit a large quantity of oil quickly. The operator pours the oil on the several bearings, never noticing, apparently, that more oil runs off than remains. For every drop of effective oil used, probably 20 drops are wasted, and may be found in unsightly blotches on the side of the machines, as well as on the floor, making any operation necessary around these parts dirty and disagreeable work. A drop of oil put in the right place will do good work, but to do this it is necessary to repeat the operation oftener, and this is the reason why the oil is slapped on in large quantities, so as to last all day.

STEAM TURBINES.

By James Asher.

Inventors in our time seem to neglect the reaction principle in steam turbines. The first was Hero's edipile, which was invented about two thousand years ago and has been almost neglected ever since. Richard Trevithick constructed a turbine somewhat resembling Hero's early in the nineteenth centnry. It differed from Hero's edipile in this respect that it had no globe. Two hollow arms diametrically opposite each other received steam from a hollow shaft and discharged it at the edge of each blade near its outer end. Avery, of New York, constructed one somewhat similar to that of Trevithick about the middle of the last century. Mr. Charles H. Parsons also built one of similar construction to that of Trevithick. The hollow arms were of elliptical cross section and the steam issued through short tubes in a direction which was nearly tangential to the circumference of the circle, which was described by the outer ends of the rapidly rotating arms or blades. The turbine was shut up in a casing of cast iron, and the exhaust steam flowed into a condenser.

A speed of 5,000 revolutions was obtained from this turbine. The steam pressure was one hundred pounds on each square inch, and the steam exhausted into a condenser which had a vacuum of twenty-six inches. The turbine was tested and was found to yield twenty horse power, and to use forty pounds of steam for each useful hourly horse power. An aged British engineer told the writer that he had a turbine of Trevithick's type many years ago, and which he called a sword engine, because the forward edges of the blades were sharp that they might cleave the exhaust steam and thereby yield more power than could otherwise be produced. This aged engineer carried his turbine in his hand from place to place. He had it wrapped in paper like a parcel of goods. When asked what it was he said that it was an engine with which he meant to drive his saw mill. The hollow blades were about two feet long ; the speed was about three thousand revolutions a minute. In regard to economy of steam this turbine was about equal to ordinary reciprocating engines of that time. The aged engineer stated that the only thing that could be said against the turbine or sword engine which he used was that in order to secure economy of steam it was absolutely necessary to employ steam of exceedingly high pressure. Consequently a strong boiler was required. This engine was made more than a generation ago, when boilers were not so capable of enduring high pressures as they are at the present time.

Why has the reaction turbine not been brought into extensive use ? I have little doubt that an engine made exactly like Hero's, if supplied with steam of high pressure, would be as economical of steam as half the stationary engines which are now in use. I dare say that if one were constructed of say six feet in diameter or having blades of about three feet in length, discharging steam from the sides of the arms through holes of several inches in area, it could easily be made to yield more than three thousand horse power. Such a turbine would cost comparatively little and would occupy extremely little space. Should it be found that too great loss of power from churning the exhaust steam would occur, the turbine might be made in the shape of a wheel, discharging steam tangentially at the circumference. A casing allowing considerable space between itself and the turbine should in all cases be employed.

Dow's steam turbine has several rows of blades which are concentric to each other, and to as many rows of stationary guides. This is an outward flow turbine. There are equal numbers of rows of blades at the right and left of the entrance of the steam into the casing, consequently there is no end thrust on the shaft. This turbine has shown an economy of steam which is fair, considering the small size of the machine. It has been used in propelling the Howell torpedo.

Mr. C. H. Parsons' turbine is a compound wheel having a large number of blades, running between as many rows of guide blades, which are stationary. The blades or buckets of the wheel are larger and farther apart as the steam proceeds in order to give room for steam of diminished elasticity and consequently increased volume. There are blades on barrels of four different diameters, and there are many rows on each barrel. There are baffle pistons mounted on the shaft in order to counteract the end thrust on said shaft. In order to permit smooth motion, although the turbine may not be perfectly balanced, the journals run in several concentric sleeves supplied with oil under pressure. The governor permits the passage of the steam into the turbine in gusts. These gusts succeed each other more or less rapidly and endure for varying intervals according to the power required in order to maintain the proper motion of the turbine. This turbine contains an enormous number of pieces. For instance, one having a capacity of four hundred and two horse power has thirty-one thousand and seventy-three blades. Sixteen thousand and ninety-five of these blades are in motion, according to the statement of Mr. Francis Hodgkinson. A turbine of four hundred and two horse power, such as has just been described, yielded an electric hourly horse power with a consumption of steam which was only 16.4 pounds at full load. The same machine at one-quarter load used 22 pounds of steam for each hourly electric horse power. A Parsons' turbine of sixteen hundred and eight horse power developed the hourly electric horse power with fourteen pounds of steam. In Hartford, Conn., a Parsons' turbine of four thousand and twenty-one horse power is in course of erection. It will drive a generator for the electric light company. The wheel or runner weighs fourteen tons and is nearly twenty feet long. It is six feet in diameter at the widest part.

De Laval's steam turbine is a wheel having buckets round its circumference. A hoop is fastened on the periphery of the buckets. Steam is blown from several nozzles at an angle against the buckets on one side of the wheel, and the steam exhausts into a chamber on the other side. The wheel is mounted on a long thin shaft in order that the wheel may rotate about the proper axis when running at tremendous speed. This turbine has been used in driving centrifugal creamers and in driving dynamos. For driving these it is provided with fine gearing, because the speed would otherwise be too great for existing dynamos. The result of one trial showed that a De Laval turbine yielded three hundred and eight horse power with less than fourteen pounds of steam for each hourly actual horse power. The steam pressure was one hundred and ninety-two pounds to the square inch ; the steam was superheated sixty-nine degrees Fahr., and the speed was seven hundred and seventy-two revolutions a minute.

In 1897 four groups of DeLaval turbines and generators of one hundred horse power each, and two groups of fifty horse power each, were in operation at the Stockholm Exhibition. Each group was entirely self-contained ; boiler, turbine and dynamo all being set up on one base. The boilers were made of concentric coils of pipe of little more than an inch in diameter, consequently they were capable of sustaining enormous steam pressures. Steam was actually used in these boilers and turbines at a pressure of three thousand two hundred ahd thirty-four pounds on the square inch. Each pound of fuel in the furnace furnished from seven to eight pounds of steam. What the economy of the turbine proved to be has not been stated. The temperature of steam at three thousand two hundred and thirty-four pounds on the square inch is seven hundred and seven degrees Fahrenheit. In a theoretically perfect engine receiving steam at seven hundred and seven degrees, and exhausting it at two hundred and forty degrees, the efficiency according to the second law of thermo-dynamics would be $\frac{(707+459)-(240+459)}{707+459}$ or forty per cent. This is more than double the highest efficiency ever yet obtained by a reciprocating engine.

Of course, according to theory, it makes no difference what type of engine is used in order to obtain a given percentage of efficiency. But such high pressures as were used in the DeLaval turbine could scarcely be used in any reciprocating engine whatever.

Within the past year or two it has been shown by Professor R. H. Thurston that a very great increase in economy is obtained in DeLaval's turbine by superheating the steam before it enters the turbine.

It is certainly remarkable that steam turbines have been so little used. They have shown economy equal to the most economical reciprocating engines ; they have no dead centres ; the angular velocity is absolutely uniform at all points of the revolution. The turbine runs silently ; it occupies very small space ; it is not likely to get out of order ; it can use enormous steam pressures because the hot steam meets neither oil nor packing. The cost is low and the attendant requires no special skill.

Mr. W. T. Jennings, of Toronto, recently made surveys for a street car system in the town of Parry Sound, Ont.

The Electric Cab Company, Limited, of Toronto, has been incorporated, for the purpose of manufacturing and operating automobiles for general use.

Manchester, Robertson & Allison, Limited, have been incorporated in St. John, N. B., with a capital of $800,000, to supply electric light and power.

SPARKS.

Messrs. Blanchard & Company, of Windsor, N.S., have installed a private electric light plant.

Mayor Hayward, of Victoria, B. C., is in favor of an extension of the city's electric light plant.

The town council of Almonte, Ont., have decided to engage an expert to value the electric light plant.

The light commissioners of Brockville, Ont., will take steps immediately to improve the electric light plant.

The annual meeting of the Lachine Rapids Hydraulic & Land Company will be held in Montreal on February 14th.

It is stated that a New York syndicate is about to develop the water power of the Pend d'Oreille river near Rossland, B. C.

The Mayor of Walkerton, Ont., has suggested that consideration be given to the question of establishing a municipal electric light plant.

A company is being formed at Bic, Que., to light that village by electricity. It is proposed to purchase the water power of Mr. Alf. Bouillon.

It has been suggested that the village council of Kamloops, B. C., should this year take up the question of improving the electric light plant.

The White Pass & Yukon Railway Company has recently added to its equipment at Skagway an electric light plant capable of supplying 800 lights.

Specifications ard being prepared on which to invite tenders for the electric lighting of the streets of Montreal upon the expiration of the present contract.

The Levis Electric Railway Company is seeking incorporation, to build an electric railway in that town and adjoining counties of Levis, Dorchester, and Bellechasse.

The British Columbia Electric Railway Company will this year make improvements to their plant at Victoria. The road bed will be improved and the system extended.

The Niagara District, Welland Port and Dunnville Electric Railway Company is seeking incorporation, to build an electric railway in the districts indicated by the name.

A suggestion has been made by the Mayor of Collingwood, Ont., that the services of an expert be engaged to report as to the required improvements to the electric light plant.

The town of Port Dover, Ont., is about to vote on a by-law to loan $10,000 to the Canadian Steam Carriage Company to establish a factory for the manufacture of steam automobiles.

Mr. J. W. McRae, late managing director of the Ottawa Electric Company, is taking steps to organize the Consumers' Electric Company, to supply electric light and power in Ottawa and vicinity.

The Niagara, St. Catharines & Toronto Railway Company have completed surveys for their westward extension towards Hamilton. The company also propose to build a spur line from Beamsville to St. Ann' s or Smithville.

The development of the water power of the Current river is now engaging the attention of the municipal authorities of Fort William, Ont., the proposition having met with the almost universal assent of the ratepayers.

The Citizen Electric Light Company has been formed at Leamington, Ont., and at a recent meeting Dr. Hughes, Messrs. J. A. McDonald, W. T. Easton and others were appointed a committee to proceed with the purchase of a plant.

At the annual meeting of the Niagara Falls, Wesley Park & Clifton Tramway Company, held on January 24th, officers were elected as follows: President, John W. Gilbert; vice president, Joseph A. Powers; treasurer, A. B. Colvin; secretary, F. C. McBurney.

At the annual meeting of the Winnipeg Street Railway Company held a fortnight ago, Mr. William Mackenzie was elected president, Mr. William Whyte vice-president; and Mr. F. Morton Morse secretary and treasurer. The old board of directors were re-elected.

Before the Peterborough Engineering Club recently, Mr. H. D. Burnett, of the Canadian General Electric Company, gave an interesting address on the "Nernst Lamp," showing by means of diagrams its construction and mechanism, and pointing out the field in which this form of lamp would find its usefulness.

The Maitland River Power Company has been organized, with Mr. James Clark as president. The company have in view the development of the power of the Maitland river near Goderich, and have made a proposition to that town to supply power sufficient to operate the waterworks and electric light plants.

A company is being formed in Montreal to establish an electric plant near Riviere des Prairies, to supply electric light and power in Sault au Recollet, Longue Pointe and other towns. The promoters include Messrs. Eugene Mony, civil engineer, and J. A. O. Laforest, former superintendent of the Montreal water department.

The stockholders of the Carillon & Grenville Railway Company, at their annual meeting in Montreal recently, discussed the question of using electric instead of steam power on their railways. It seems that a number of capitalists are considering the utilization, for electrical purposes, of the power at the old Carillon canal.

A special committee of the town council of Yarmouth, N. S., has been investigating the various methods of street lighting, and has recommended an electric plant using both enclosed arc lamps and 50 c. p. incandescent lamps. It is estimated that the cost for a plant to supply 31 arc lamps and 80 incandescents would not exceed $9,000.

The second annual meeting of the Renfrew Electric Light Company, of Renfrew, Ont., was held last month. A half yearly dividend at the rate of 6 per cent. was declared, and the following officers and directors elected : A.A. Wright, president ; A. H. Hough, vice-president ; H. Wright, secretary-treasurer ; Wm. Ringslenben and C. H. Wright (Toronto.) The new plant of the company is being installed.

At a recent meeting of shareholders of the General Engineering Company of Ontario, Limited, it was decided to change the name of the company to the Underfeed Stoker Company, Limited. The following gentlemen compose the new board of directors : President, Geo. Gooderham ; vice-presidents, John B. Laidlaw, D. Fasken, W. D. Matthews, J. L. Ross, J. D. Wright, Elias Rogers, H. M. Pellatt, T. G. Blackstock ; secretary, T. A. Rowan.

The annual meeting of the three electric railway lines controlled by the Cataract Power Company, of Hamilton, took place recently, when the following officers were elected: —Hamilton Street Railway—President, Hon. J. M. Gibson: vice-president, John Dickenson, M.P.P. ; secretary, John Patterson ; treasurer, John Moodie. Hamilton Radial Company—President, John Patterson ; vice-president, Hon. J. M. Gibson ; treasurer, John Moodie. Hamilton & Dundas Railway —President, John Dickenson, M. P. P. ; vice-president, J. A. Kammerer, Toronto ; secretary, John Patterson ; treasurer, John Moodie.

MOONLIGHT SCHEDULE FOR MARCH.

Day of Month.	Light.	Extinguish.	No. of Hours.
	H.M.	H.M.	H.M.
1....	2.30	5.45	3.15
2....	3.15	5.45	2 30
3....	3.45	5 45	2.00
4....	No Light.	No Light.	
5....	No Light.	No Light.	
6....	P.M. 6.20	P.M. 9.00	2.40
7....	6.20	10.00	3.40
8....	6.20	11.00	4.40
9....	6.20	11.45	5.25
10....	6.30	0.30	6.00
11....	6.30	A.M. 1.30	7.00
12....	6.30	2.30	8.00
13....	6.30	3.30	9.00
14....	6.30	4.00	9.30
15....	6.30	4.45	10.15
16....	6.30	5.30	11.00
17....	6.40	5.30	10.50
18....	6.40	5.30	10.50
19....	6.40	5.30	10.50
20....	6.40	5.30	10.50
21....	6.40	5.30	10.50
22....	6.40	5.30	10.50
23....	6.40	5.15	10.35
24....	6.40	5.15	10.35
26....	11.00	5.15	6.15
27....	0.00	5.15	5.15
28....	0.30	5.15	4.45
29....	A.M. 1.00	5.15	4.00
30....	1.45	5.15	3.30
31....	2.00	5.15	3.00
		Total	197.50

LARGEST INDUCTION MOTOR IN THE WORLD.

What is claimed to be the largest induction motor yet constructed has been installed by Brown, Boveri & Company, of Baden, Switzerland, in the waterworks station at Geneva. It is 1,000 horse power, and is directly coupled to a centrifugal pump. The motor weighs 27 tons, and runs at a speed of 544 revolutions per minute. The stator has ten poles, with six holes per phase per hole. The rotor has 180 holes, with two conductors to each hole, connected like a cylindrical drum armature with a three circuit wave winding. The motor is operated at 5,000 volts and an unusually high speed.

WIRE FOR FUSES.

Following are the sizes of copper wire to use for fuses from 25 to 100 amperes :

25 amperes	No. 25
30 amperes	No. 24
35 amperes	No. 23
40 amperes	No. 22
50 amperes	No. 21
60 amperes	No. 20
70 amperes	No. 19
85 amperes	No. 18
100 amperes	No. 17

LEGAL.

It is learned that the action brought by Mr. William Harris against the Toronto Electric Light Company has been withdrawn. Mr. Harris claimed $10,000 damages for the destruction by fire of his building on William street, Toronto, a year or two ago. He claimed that the fire was due to the contact of the Electric Light Company's wires with the building, and that the company had attached the wires to the building without his consent. The case was argued in the lower courts and an appeal taken, which appeal is said to have now been withdrawn.

BRITISH ELECTRICAL WORKS.

We are in receipt of a brochure containing a description and excellent half-tone illustrations of the magnificent new works of the English Electrical Manufacturing Company, Limited, of Preston, Lancashire, England. These works, which were completed about six months ago, are unique in many respects, and their erection was the result of the immense quantity of electrical apparatus imported from Germany, America and other countries. Of the twelve acres of land embraced in the company's manufactories, about five acres are under roof. The buildings are laid out on the lines of the most recent American engineering works, the steel frame being first erected to carry the cranes and roof structure, and the sides and ends independently walled in. The machine shop, the largest building, is 900 feet in length by 120 feet wide, and the equipment is second to none. The English Electric Manufacturing Company is the pioneer undertaking of the kind in the United Kingdom, and is now prepared to carry out electric undertakings of all kinds, whether in lighting, locomotion, or electric transmission of power. The well known firm of Dick, Kerr & Company, 110 Canning street, London, E. C., are sole selling agents for the company.

TRADE NOTES.

The Robb Engineering Co., Limited, have received an order from the Dominion Iron & Steel Co. for a 100 horse power Mumford standard boiler, this making the eleventh of this type shipped to the Steel Company.

The electrical business of Ahearn & Soper, Ottawa, has been incorporated into a joint stock company, under the name of Ahearn & Soper, Limited.

The Montreal Street Railway Company has placed an order with the Canadian General Electric Co. for a direct connected railway power generator of 850 k.w. capacity, or about 1,200 horse-power. It will be installed at the company's steam station, and will be directly conected to a cross compound engine.

Messrs. Kelley & Walker, of Vancouver, B. C., have received a contract from the Dominion Government to build a telegraph line from Golden through the Columbia valley.

METERS

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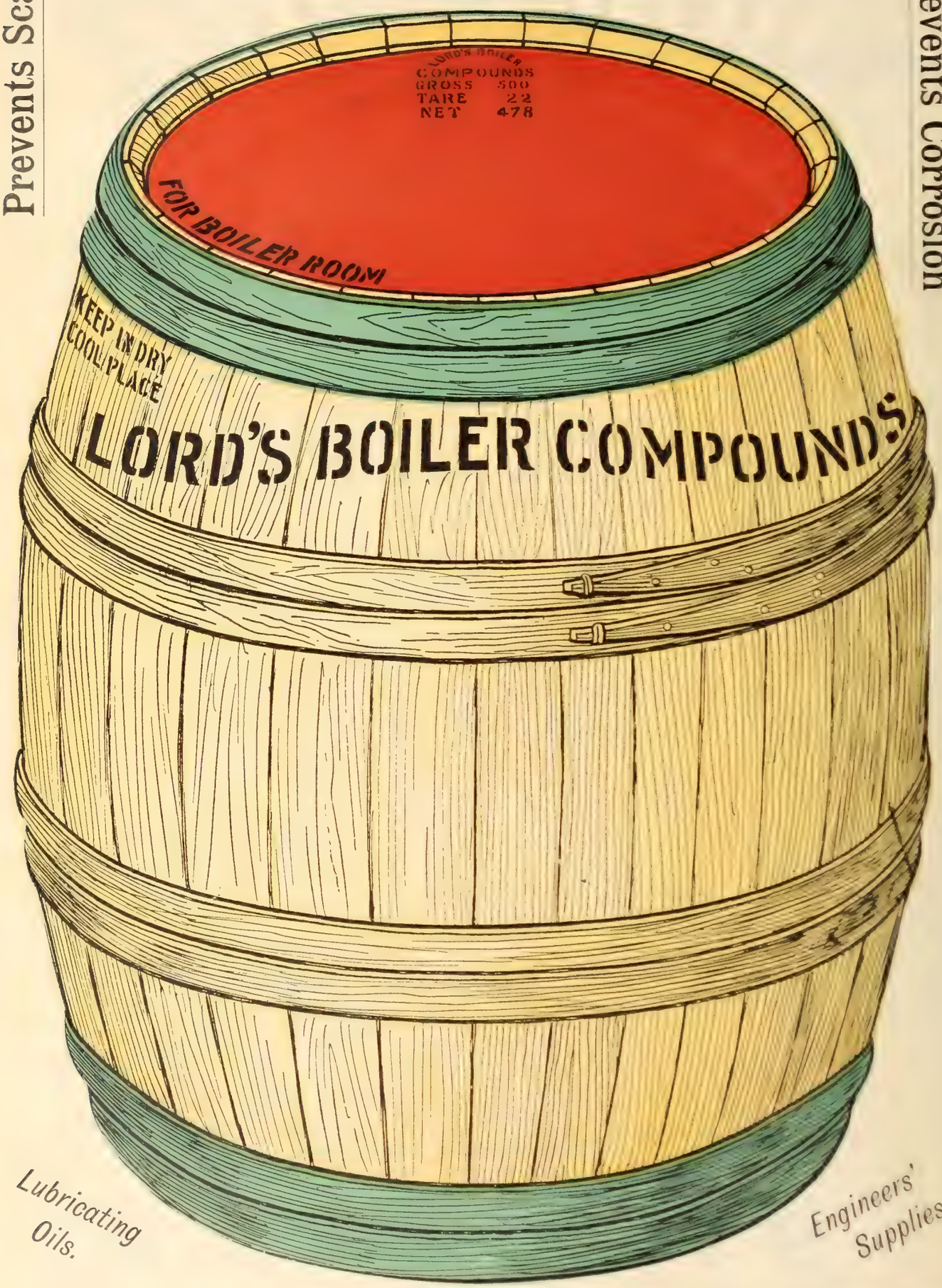
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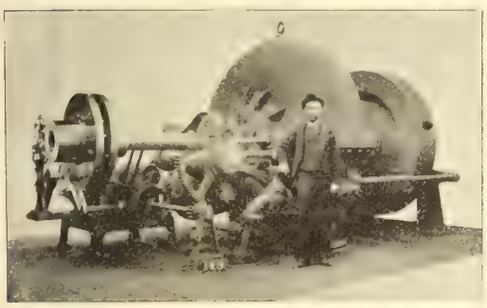
THE OTTAWA ELECTRIC RAILWAY COMPANY.

The annual meeting of the shareholders of the Ottawa Electric Railway Company was held last month. The report of the directors showed that the net profits of the year were $101,116.57. The gross earnings were $314,146.64, compared with $231,802.06 in 1898 and $263,545.05 in 1899. Four quarterly dividends of two per cent. were paid and a substantial balance carried to the credit of profit and loss. The number of passengers carried during the year was 7,940,056, an increase of nearly 2,000,000 over the previous year and of 5,500,000 over the year 1892. The following officers and directors were elected: President, T. Ahearn; vice-president, Peter Whelen; secretary-treasurer, J. D. Fraser; directors, Warren Y. Soper, A. Lumsden, M. P. P., Hon. G. A. Cox, George P. Brophey, C. E.

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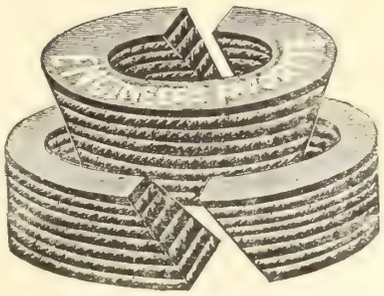
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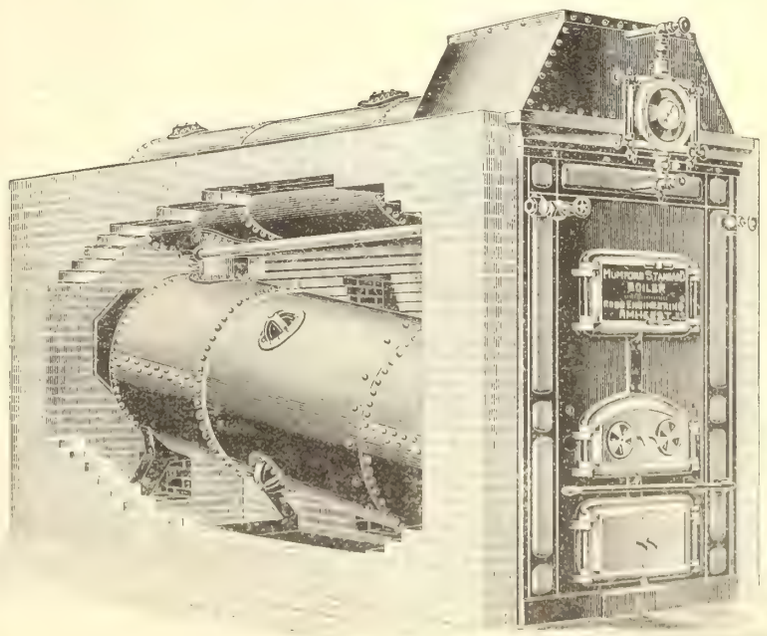
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SPARKS.

The Brome Lake Electric Company, of Waterloo, Que., has applied for a charter of incorporation.

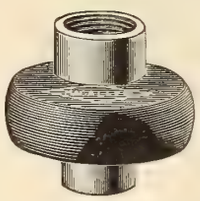
The citizens of Annapolis, N. S., have decided in favor of purchasing the plant of the Odell Electric Light Company.

The T. Eaton Company, of Toronto, have ordered a number of enclosed arc lamps from the Manhattan General Construction Company.

The West Kootenay Power & Light Company, of Rossland, B. C., are understood to have decided to make considerable additions and improvements to their plant at Bonnington Falls. The present capacity is 5,000 horse power, which will probably be increased.

Mr. Thos. A. Edison, the great inventor, is now devoting his attention to perfecting a machine for the generation of electricity direct from coal without the aid of an engine or dynamo. The details of the new electrical wonder have not yet been announced, but it is said that they will be made public in the near future. This invention, it is asserted, will not only revolutionize travel both on land and sea, supplanting the throbbing triple expansion engine of the ocean liner with a small oil stove, and the monster boiler of the ponderous locomotive with a light cylinder, but will also revolutionize the use of electricity in homes and offices. The invention is the result of experiments extending over a period of years.

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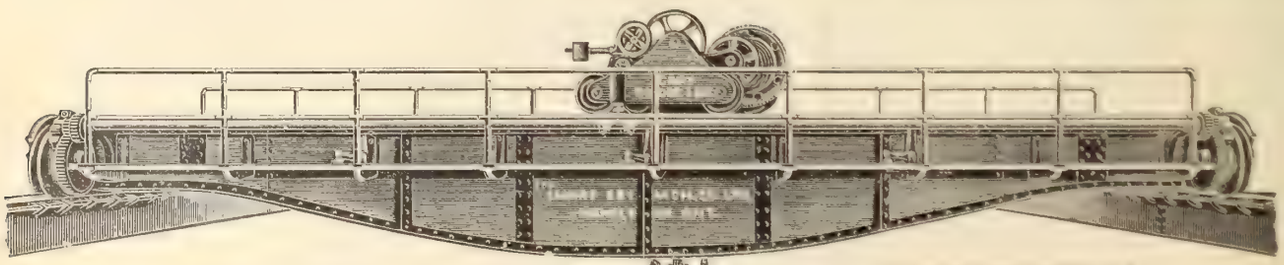
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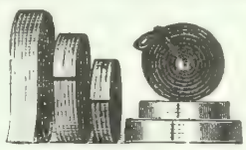




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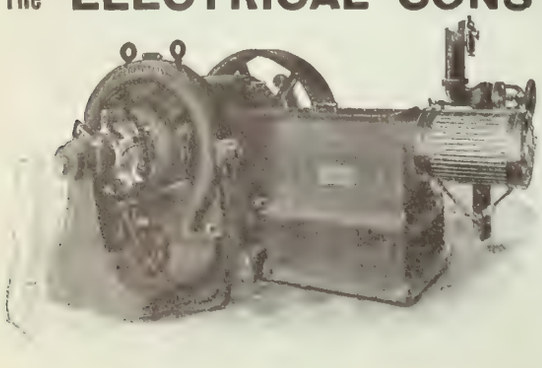
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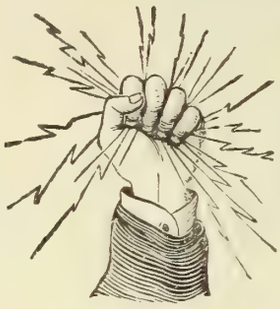
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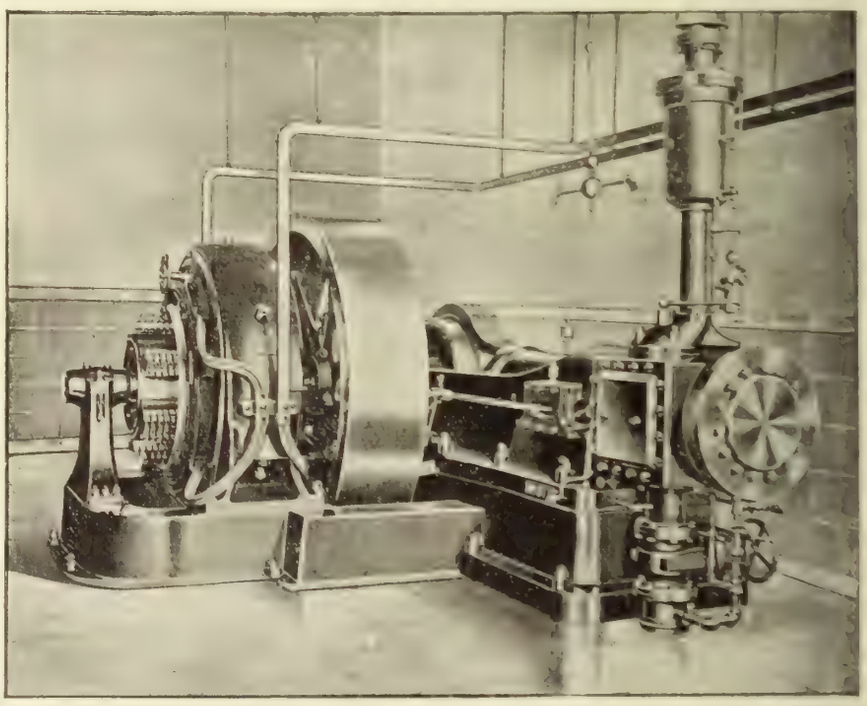
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SPARKS.

The town council of Dresden, Ont., are talking of purchasing the electric light plant.

The St. Thomas Electric Street Railway Company will extend their railway to Port Stanley in the spring.

William McPherson has established a factory at St. Marys, N. B., to manufacture steam and gasoline engines, motors, etc.

The business of I. H. Breck, dealer in electrical supplies, Kingston, Ont., will in future be conducted under the name of Breck & Halliday.

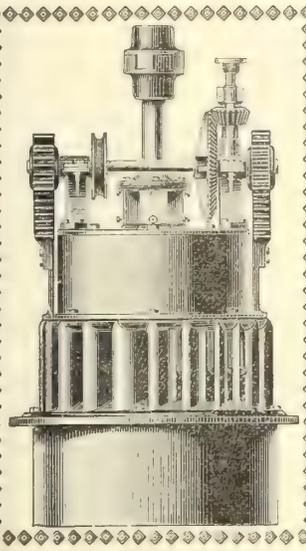
At a recent meeting of the National Association of Marine Engineers in Toronto, a lecture on "Shafts; their care and repair" was given by Mr. Craig.

The new plant installed by the Parry Sound Electric Light Company was put in operation a few weeks ago. It is a duplicate of the original plant, and was installed under the supervision of Mr. J. W. Easton.

The town of Parry Sound, Ont., will be asked to grant a bonus of $20,000 towards the construction of an electric railway to Ahmic Harbor. Surveys for such a road have been made by W. T. Jennings, C. E., of Toronto.

The contract for electric wiring and fittings for the proposed new hotel on King street, Toronto, is one which will doubtless result in sharp competition. It is hoped that the contract will be secured by a Canadian firm.

A New York syndicate have taken an electric plant to the Kolar gold fields in India, to be used in mining operations. It is a new feature in gold mining in India, and is expected to increase the production and to reduce the expense of working.



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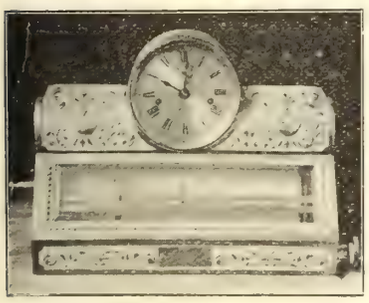
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The town of Rat Portage, Ont., may take over the electric light plant.

The city of Woodstock, Ont., has finally taken over the electric light plant.

Breck & Halliday, of Kingston, Ont., have secured the contract or electric fixtures for the Rockwood asylum.

The town of Granby, Que., has recently purchased a large number of meters from the Canadian General Electric Company.

The town council of Portage la Prairie, Man., are negotiating with the Central Electric Company for a renewal of their contract for street lighting.

The Canadian Pacific Railway Company purpose establishing an electric plant at Toronto Junction, Ont., for lighting their shops, yards and station.

Kingston electrical contractors are now figuring on the lighting of the armouries in that city. The plans provide for 187 incandescent and 8 arc lights.

Mr. J. R. Booth is said to be associated with the Consumers' Electric Company, of Ottawa, which is being organized by Mr. J. W. McRae. The company have asked for a franchise extending over a period of twenty years.

The Qcebec Suburban Electric Railway Company is applying for incorporation, to build an electric road from the city of Quebec across the parish of Limoilou and along the south shore of the St. Lawrence, in the counties of Levis and Lotbiniere.

The citizens of Welland, Ont., have appointed a committee, consisting of the Mayor and Messrs. G. H. Berger, D. Hooker, Wm. Beattie, W. J. Best and R. L. Hamilton, to obtain information as to the cost ot installing a municipal electric light plant.

The Niagara Falls Power Company has about completed its second power transmission line between Niagara Falls and Buffalo. The line is of aluminum wire and consists of three cables, each composed of 37 strands. The old line consists of six copper cables of 19 strands each. Owing to the lightness of aluminum the spans between poles average 112 feet, while in the old line the average was 75 feet. The voltage in transmission has been raised from 11,000 to 22,000 volts.

The vote by the ratepayers of Port Arthur, Ont., on the question of developing the water power of the Current river, was 274 for and 27 against the by-law.

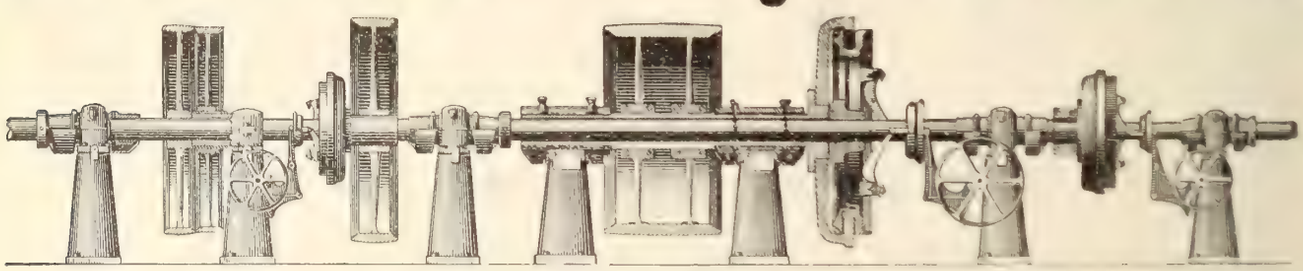
Mr. Frank A. Hibbard, C.E., is preparing plans for the development of the water power at the Chaudiere, Ottawa, acquired by a syndicate from the Hull Lumber Company, and the contracts for turbines, etc., will shortly be awarded. It is proposed to build a pulp mill and other industries. Messrs. H. K. Egan, Hiram Robinson, and W. C. Edwards, M. P., of Ottawa, are interested.

The annual meeting of the Cataract Power Company, of Hamilton, was held last month. The gross receipts of the company for the year, including the railways operated, were $421,311.38. The company during the year more than doubled their power producing capacity. The question of extending their radial line to Oakville was considered. The directors were re-elected, as follows: President, Hon. J. M. Gibson; vice-president, James Dixon; secretary, John Patterson; treasurer, John Moodie.

Mr. Henry M. Whitney, the well-known Boston capitalist, is of the opinion that the most satisfactory way to get rid of the smoke nuisance is to provide smokeless fuel. This he is doing on a large scale for the city of Boston, having erected there 400 by-product coke ovens in which the coal of Cape Breton is converted into a cheap smokeless fuel, while the gas, tar, and ammonia which it contains are all saved and sold at good prices. The coke thus produced has been found very suitable for domestic and manufacturing purposes, and has been used with advantage on railway locomotives.

The annual report of the Halifax Tramway Company, Limited, of Halifax, N. S., presented at the annual meeting, showed that during the year 1900 there was a decided increase in business. The net profits were $74,631.93, as compared with $61,798.67 for the previous year. The operating expenses increased during the year $16,000. The number of passengers carried by the railway was 352,580 greater than in the previous year. On the lighting system the equivalent of 2,408 sixteen c. p. lamps were installed, making the total installation equal to 19,675 incandescent lamps. Mechanical stokers were placed under four boilers and the power station equipment increased by one 750 horse power condenser. Line transformers of 97,000 watts capacity and 125 meters were installed.

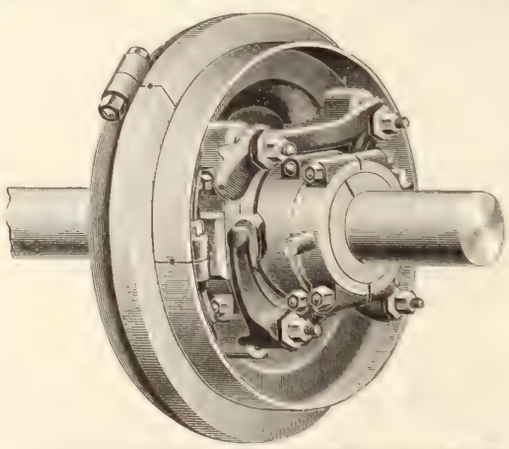
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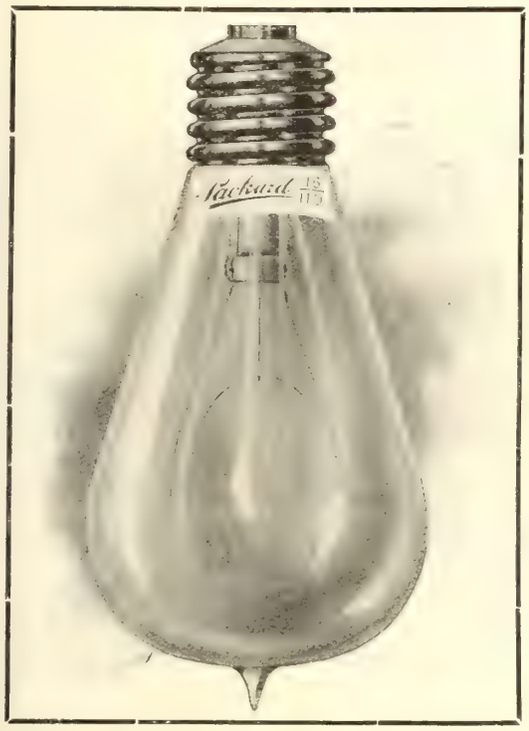
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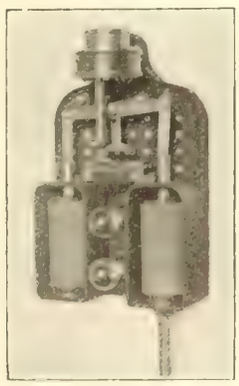
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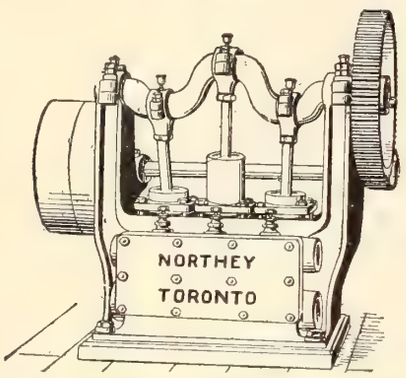
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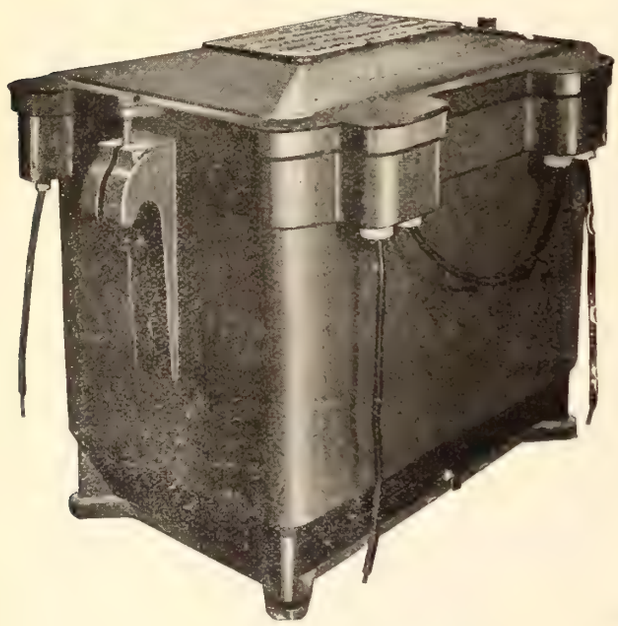


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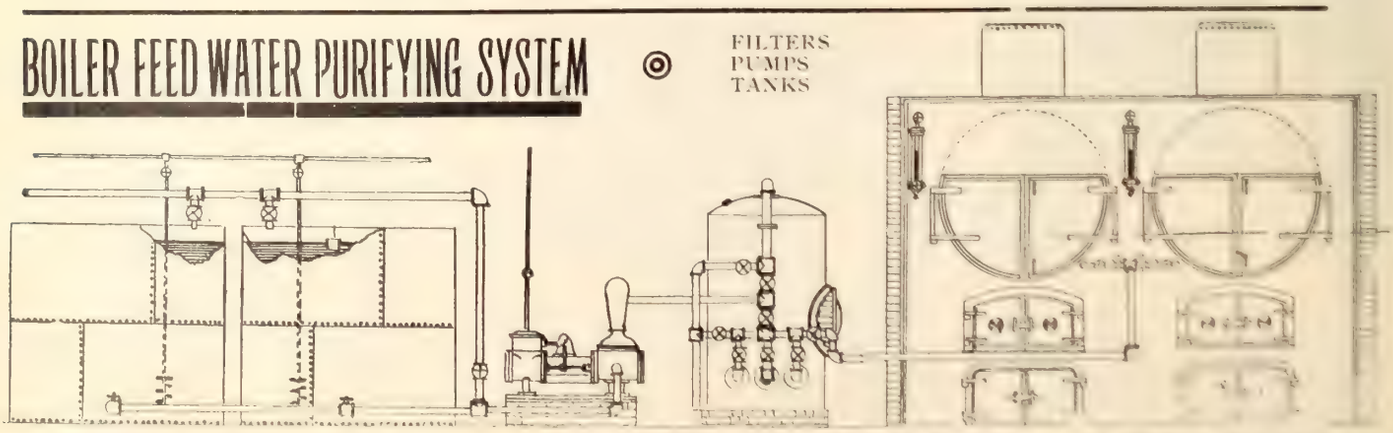
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CANADIAN

ELECTRICAL NEWS

AND

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VOL. XI. MARCH, 1901 No. 3.

THE AUTOMOBILE INDUSTRY AND ITS DEVELOPMENT IN CANADA.

The progress that has been made in the few years since the horseless carriage was first recognized as a possible factor in transportation would seem to have met the expectations of the most sanguine, and shattered the predictions of the many who characterized the movement as a passing fancy. Originating in France, the horseless carriage agitation speedily spread to Germany, Belgium, England and other European countries, thence across the Atlantic to the United States and Canada. The introduction of the bicycle, with its pneumatic tire and ball bearings, seems to have brought to the attention of the people the possibilities and advantages of a carriage propelled by mechanical power.

That France is foremost in the development of the automobile industry is probably due in a large measure to the excellent roadways in that country. In 1898 it was estimated that the sum of $150,000,000 was invested in the automobile industry in France.



NO. 1. -ELECTRIC "VICTORIA." -CANADIAN MOTORS, LIMITED.

In 1895 horseless carriages were exhibited at various fairs in England. They were invariably viewed with amazement by large crowds, as previous to that year very few had been seen on the streets. In the same year a contest was held in Chicago, when a prize of $5,000 was offered by the Times-Herald newspaper. At this event six vehicles started, the Duryea gasoline motor carriage being the winner, covering fifty-six miles, over bad roads, in less than eight hours. The vehicle weighed 1,208 pounds. This contest was no doubt of great benefit in assisting the expansion of the automobile industry and in finding a place for that class of vehicle amongst the needs of modern civilization. Previous to this demonstration, what the motor carriage could do on the ordinary class of roadway was regarded as very uncertain. In the intervening years since 1895 the automobile industry has been placed on a commercial basis, and to-day hundreds of machines are in use in the United States and Canada for transportation purposes.

The one feature upon which there is much difference of opinion, and which has demanded more hard, earnest study and investigation than any other branch of the business, is the motive power. From the first various kinds of power were employed—benzine, petroleum, compressed air, gasoline, steam, electricity, etc. Each had its advocates, and, according to the views of some, its drawbacks and defects. This struggle for supremacy in the motive power field still exists, with the balance of sentiment and number of vehicles in use in favor of gasoline, steam and electricity.

It is quite generally admitted that no type of vehicle will fully meet the requirements of all conditions for pleasure and business. Each type appears to have its field of usefulness, and development is likely to take place along the line of gasoline, steam and electric automobiles.

At the first annual exhibition of the Automobile Club of America, held in Madison Square Gardens in New York in November last, two vehicles attracted particular attention. One was a three-wheeled gasoline runabout, equipped with a four h.p., air cooled gasoline engine, regulated by a combination of variable compression and speed-changing gear. The other was an electric carriage for two persons which weighed only 550 pounds, and was equipped with a ¾ h. p. electric motor, chain-geared to the rear axle. A number of the small parts of this vehicle were made of a nickel-aluminum alloy, in order to reduce the weight as far as possible.

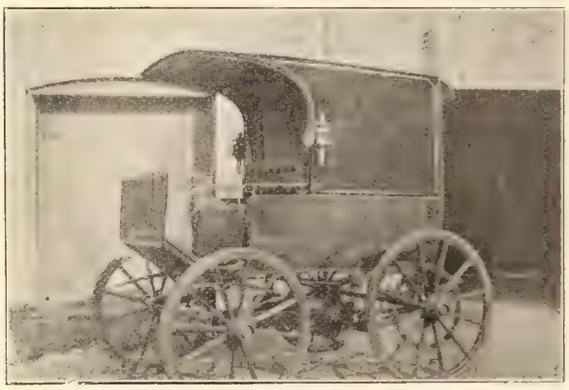
The cost of repairs is a point of considerable importance in motor vehicles. The Automobile, an American publication, recently secured statements from twenty owners of automobiles of various types showing actual results of 75,000 miles of road use. Five gasoline machines, reported with a mileage of 6,300, show repairs to have cost $470, or approximately seven cents a mile. Twelve steam vehicles, with a mileage of 26,500, show a repair bill of $1,532, or approximately five cents a mile. For four electric vehicles, with a mileage of 43,000, the expense of repairs was $420, or just a shade under one cent a mile. These figures, it will be seen, are strongly in favor of the electric carriage.

A question of some moment is how far an electric carriage will run without being recharged. In this connection it is of interest to note that an electrically propelled carriage carrying two persons made a trial trip from London, Eng., to Brighton, using one charge

of electricity only, the total distance covered, as shown by the cyclometer, being fifty-three miles. The run was made at an average speed of ten miles per hour.

THOUSAND-MILES AUTOMOBILE TRIALS.

That the gasoline motor has been developed in France and England to a much greater extent than any other type of motor is shown by the competition of motor cars which was inaugurated last year by the Automobile Club of Great Britain and Ireland. The distance to be covered was 1,050 miles. Of eighty-three vehicles entered for the trial sixty-five started, forty-nine of which succeeded in reaching the point of destination. All the vehicles, with four exceptions, were propelled by petroleum spirits. Several hundred miles of road were of the average good surface English roads, but there were at least two hundred of very bad surface and some steep hills. The grades included : 13,320 feet from 6 to 8 per cent.; 38,300 feet 6.5 per cent.; 7,338 feet 10 per cent.: 9,040 feet 9 per cent.; 10,500 feet 9 per cent. In the open country on good roads high speeds were occasionally made, some carriages reaching over forty miles per hour. With a steam carriage the average actual horse-power shown by the hill trial was 1.83, and the mechanical efficiency 0.61.



No. 2.—Electric Delivery Wagon.

AUTOMOBILE PROGRESS IN CANADA.

The city of Toronto represents the centre of automobile progress in Canada. The first motor carriage to be built in this country was seen on the streets of Toronto in the fall of 1896. The motive power was electricity, the storage battery employed being the invention of Mr. W. J. Still, a local electrician. This carriage was owned by Mr. F. B. Featherstonhaugh, patent solicitor, and, somewhat modernized, is still in use. The battery consisted of twelve cells weighing 23¼ pounds each, giving a maximum of about 4 h.p. The cells were of the lead-lead pasted tyye, their average voltage being about 1.9 for the entire discharge. The motor was of the disc armature type, six polar, the field being series wound. When the battery was fully charged it was estimated that it was capable of propelling the carriage about sixty miles without recharging. The total weight of the vehicle was 750 pounds, of which 350 pounds represented the electrical equipment. The advent of this carriage was followed by the introduction of American carriages of various kinds.

The battery invented by Mr. Still was recognized as one of considerable merit, and a company was formed, known as the Still Motor Company, to manufacture electric vehicles of all kinds. In 1899 a factory was established at 710-724 Yonge street. The business was shortly afterwards purchased outright by British capitalists, who now conduct it under the name of Canadian Motors, Limited.

CANADIAN MOTORS, LIMITED.

The factory of the Canadian Motors, Limited, embodies every facility for the manufacture of electric carriages. Although the present premises are commodious, the business of the company is expanding to such an extent that it is proposed either to build an addition to their present building or secure larger premises elsewhere. The company have shipped a large number of carriages to Great Britain, where they seem to be meeting with general favor. In a recent international contest in London, England, held for the purpose of testing the speed and hill-climbing power of electric vehicles, thirteen racing machines competed. Canadian Motors, Limited, of Toronto, entered one of their ordinary road wagons which had been shipped to London some months previously, and according to the odometer on the wheel had run over 6,000 miles during the summer. The Canadian vehicle, we are told, carried four persons throughout the contest, while all the others, being racers, only carried two persons each. The first race was thirty miles over good roads, in which the Canadian vehicle came in second. The second race was thirty miles, taking in all the hill climbing, and in this the Canadian carriage came in first, with its double load of passengers, and had plenty of power to spare. The third race was the same distance over sand and heavy roads. The Canadian carriage was well in the lead at twenty-six miles, when it broke a ball in one of its bearings, which lost it the race. The carriage, however, finished the race, and, as in the other instance, had a surplus of power.

During the past six months this company have shipped over $20,000 worth of electric carriages to London, England, many of the leading persons there using them in preference to others. Besides the great demand for Canadian manufactured carriages in Europe, the Electric Cab Company, Limited, of Toronto, recently organized, have decided to use electric vehicles exclusively, and have placed a large order with Canadian Motors, Limited, for electric tally-ho coaches, victorias, broughams, landaus, oxfords, and light business runabouts, all of which are expected to be running on the streets of Toronto by the first of May.



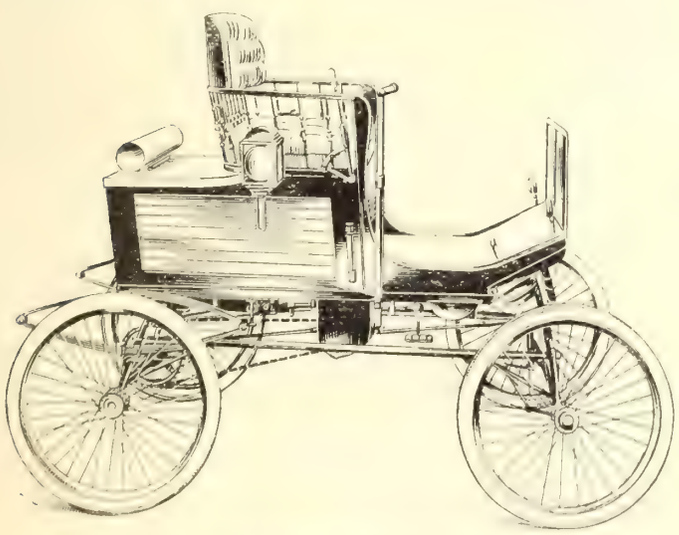
No. 3.—View of Gear of Electric Carriage, as Used by Canadian Motor's Limited.

The storage battery as now manufactured by and used in the carriages of the Canadian Motors, Limited, is claimed to offer many advantages over other makes

in the market. It is, as previously stated, the Still battery improved. Its simplicity and lightness of construction are said to make it an ideal battery for automobile purposes. One of these advantages is in the arrangement of the plates, which practically overcomes the washing action due to movement of the electrolyte in the cells during the operation of the vehicle. Another is the unlimited capacity for expansion and contraction which is claimed to overcome "buckling," while still another is the ability to charge and discharge rapidly without any deterioration of the plates. The battery for an ordinary carriage weighs about 500 pounds.

The peculiar feature of the motor is that the fields and armature both revolve in opposite directions, thereby reducing the speed one-half without gears, and also avoiding the use of differential gears. At the same time the lines of magnetic force are cut four times in one revolution, whereas in a stationary field the same number of lines are cut twice, the former method giving less work per revolution. The field magnet consists of soft steel rings to which the pole pieces are attached by means of bolts. On the end of the pole pieces are bolted phosphor bronze bells in which the armature ball bearings are placed. On these same bell ends are mounted insulated collector rings to which the wires from brushes and fields are attached. Collector dogs run on the rings, which are mounted on the case and are stationary. The whole motor is closed in a dust-proof case mounted on springs in a frame, which is fixed to the reach of the vehicle. The transmission gear is chain and sprocket ; one chain is coupled direct to sprocket on carriage wheel, the other is indirectly coupled, using an idler to get the same direction drive as the other wheel. There are three brakes, namely, foot, reverse and controller brakes. The speed may be increased or decreased, forward or backward, instantly by the simple movement of the lever.

The speed of the electric vehicle as manufactured by the Canadian Motors, Limited, varies according to requirements from three to seventeen miles an hour, although it is claimed that special vehicles can be built capable of running thirty miles an hour. A popular carriage manufactured by the company is the Victoria, of which a view is shown on the first page. This is recognized as one of their standard machines. The electric delivery wagon, shown on this page, is also a popular vehicle, as is also the Oxford. Figure 3 shows the gearing as used on their carriages.

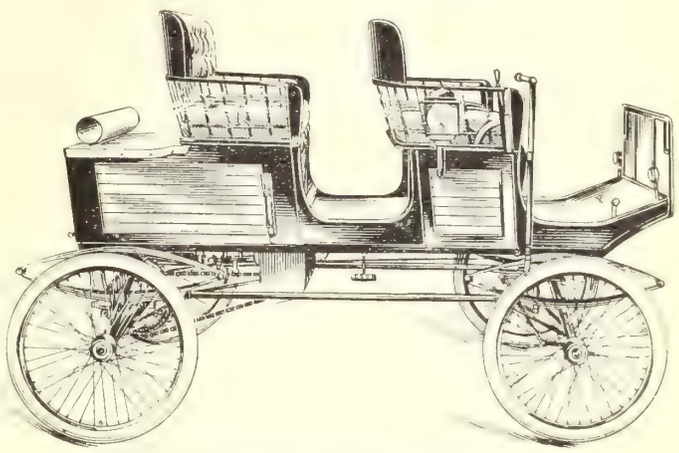


No. 4. Single-Seated Steam Carriage.

The management of Canadian Motors, Limited, is in the hands of Mr. A. M. Thompson.

STEAM CARRIAGES.

The steam motor vehicle is also popular in Toronto. Some of them have been imported from the United States; others are from the works of the National Cycle & Automobile Company, whose head offices are at 34 King Street West, and who have given much attention to the manufacture of the "Locomobile," as their steam carriage is designated. Although only engaged in this branch but a short time, the company are experiencing a very lively demand for their locomobiles. Almost every day they are in receipt of enquiries from intending purchasers in all sections of the Dominion. On the day that the writer visited their office, a letter enquiring about the steam carriage had just been received from Nova Scotia.



No. 5. Double-Seated Steam Carriage.

Three steam vehicles manufactured by this company are now employed by the post office department in Toronto. They are used for the transportation of mail matter from the Union Station to the post office, and for the collection of mail at the branch ffioces throughout the city. The accompanying view (Figure 6) shows the first automobile leaving the Union Station on July 3rd, 1900. The vehicles are equipped with a four horse power engine, the same size as is used in their one-seated runabouts. The boxes or bodies used for the post office vehicles are about three times as heavy as the body of the ordinary runabout. In addition to this weight, the post office authorities load the vehicle with from 400 to 900 pounds of mail at a time, and it is understood that so far this winter they have never missed a trip, and in nearly every instance have come in on time. It is learned from the post office authorities that the vehicles have given good satisfaction. It is the intention to send one of the vehicles to Ottawa, and in all probability the Post-master General will place orders for an additional number.

The method of construction and operation of the locomobile may not be generally known. The body contains the boiler, the engine, fuel tank and water tank. It rests on three springs, which are secured to a running gear composed of steel tubing. The water in the boiler is converted into steam by heat made from burning the vapor of ordinary gasoline, which is carried in a copper tank under the foot board. The gasoline is forced by compressed air through the boiler, where it is vaporized, and from there to the burner, where it is ignited. The compressed air is also stored in a copper tank. The operator sits on the right-hand side of the carriage, with his left hand on the steering lever. With the right hand the throttle lever is pushed forward

slowly. This admits steam to the cylinder and the carriage starts.

The steam is generated in an upright copper boiler. It is claimed that a running pressure of 150 pounds can be got in five minutes. Water is supplied to the boiler by a direct action pump connected to one of the cross heads of the engine. A by-pass lever gives the operator control of the water supply to the boiler, and a safety valve opens at 240 pounds pressure.

The engine is double acting, the reversing gear a simple link motion. With the exception of the eccentrics all bearings are ball bearings. The running gear consists of two steel-trussed ball bearing axles connected by a double reach; the whole is mounted on four pneumatic tired wheels. The front wheels are connected to their axles by swivel joints, and these are attached to the stearing gear, the lever of which controls the direction of the carriage.

The fire is controlled by an automatic valve which lowers the flame when the steam pressure reaches 180 pounds. A feature of the locomobile is the cross draught. This consists of a funnel placed at the back of the carriage and extending the full width of the carriage body.



Inauguration of the Quick Mail Delivery in Toronto.—The First Automobile Leaving the Union Station, Tuesday, 3rd July, 1900—to Deliver the Mails Which Have Been Already Sorted on the Trains, to the Branch Offices throughout the City.

It is claimed that on average roads the locomobile can be operated from 40 to 75 miles with one tank of gasoline, and from 20 to 40 miles with one tank of water. The weight of the steam carriage ranges from 640 pounds to 1,000 pounds when empty, but when the tanks are filled the weight is increased by from 200 to 300 pounds. For a carriage weighing 640 pounds the capacity of the gasoline tank would be about five gallons and that of the water tank 21 gallons. The average price of the locomobile is between $1,000 and $1,200.

The National Cycle Company have effected an arrangement by which the fire may be lighted by a match instead of by a torch. They also equip their vehicles with non-freezing devices, and guarantee that the mechanism will not be affected by the cold water. Views are shown on previous page of their standard one-seated and two-seated vehicles.

GASOLINE VEHICLES.

The Duryea gasoline carriage, which was successful in winning the prize at Chicago in 1895, has been little heard of since that time. The Winton carriage has taken the lead both in Canada and the United States. The Canada Cycle & Motor Company, of Toronto, are sole Canadian representatives for this vehicle. This company also manufacture other types of gasoline carriages, as well as motor tricycles, trailers, quadricycles, and parcel carriages propelled by gasoline.

The first Winton carriage introduced into Canada was the property of Mr. John Moody, of Hamilton. It cost about $1,000, weighed 2,300 pounds, and carried two persons. Mr. E. J. Philip, of Toronto, also purchased a Winton carriage in the spring of 1899 The carriage is built by the Winton Carriage Company, of Cleveland, Ohio. The motive power is supplied by a horizontal gasoline engine. The firing of the mixture is done by eight cells of Nungesser battery. The feature of this carriage is the method of regulation. This is obtained by making the suction or admission valve stem very long, so that it extends through a head into a small cylinder. A piston is put on the stem in this cylinder, and between the little piston and head air is pumped by a small air pump worked from the engine. On the pipe between the pump and controlling cylinder are placed two valves, one a set valve, the other being controlled by the foot at will. In starting up there is no air pressure in the small cylinder and the valve can open wide, but as the engine speeds up air is pumped into the chamber, the valve is kept closed, and the engine will slacken down and run slower, just keeping the air supplied that is escaping at the set valve. The speed is controlled by means of clutches and can be regulated by raising or lowering the foot. A number of Winton carriages are now in use in different parts of Canada.

IN OTHER CITIES.

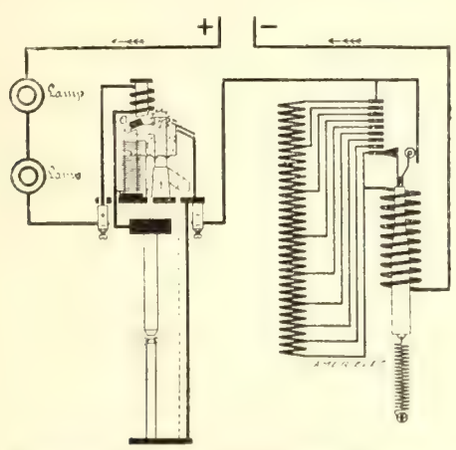
A number of automobiles of various kinds are to be seen on the streets of Hamilton, London, Ottawa, and other cities of the Dominion. In Montreal very few have as yet come into general use, owing to the steep grades. Mr. U. H. Dandurand is the owner of a steam carriage, and the National Cycle & Automobile Company have introduced their vehicles there. So far as can be learned, no carriages propelled by the storage battery by hydro-carbon are in service in Montreal. It is claimed that the hydro-carbon type, if not provided with a motor considerably larger than is necessary for usual requirements, will get "stalled" in hill climbing owing to the spark not "taking" at the proper time. It may be expected, however, that the automobile industry will be developed in Montreal as elsewhere. A company is now seeking incorporation under the name of The Montreal Automobile Company, to manufacture motor carriages. Mr. A. J. Corriveau is also interesting himself in the manufacture of such vehicles.

A company has been formed in Ottawa for the manufacture of locomobiles. It is announced that Mr. V. L. Emerson, of that city, is at work on what he claims will be the fastest and most powerful automobile ever built. It will be operated by a hydro-carbon motor.

ARC LAMPS ON INCANDESCENT CIRCUITS.

When arc lamps are run on constant potential circuits, such as those used for incandescent lamps, it is always necessary to insert a dead resistance in series with them. The reason for this is that most arc lamps regulate by the action of a shunt coil, the potential at the terminals of which varies for different currents ; if it were not for the dead resistance this voltage would remain constant, as they are connected to constant potential mains ; the dead resistance is therefore necessary to produce a variation in the voltage with the current in order to bring about regulation. Many attempts have been made to do away with this resistance, as it wastes about 25 to 30 per cent. of the energy in a circuit in which two arc lamps are connected in a series across 110-volt mains. It seems now that this important problem has been solved practically by means of a differential arc lamp which has been in satisfactory use to a large extent for some months in Berlin. With these lamps practically no such dead resistance is required, and therefore the energy is more fully utilized, with the great advantage that three lamps instead of two may then be connected in series across 110-volt mains. As will be remembered, a differential lamp is one in which the regulation is effected by both a shunt and a series coil, and any variations in the current irrespective of those of voltage are then also used to operate the regulating apparatus.

A diagram of this lamp is shown in the adjoining illustration, in which three lamps are shown in series, of which one is represented with all the connections. It will be seen that the regulation is effected by both a series and a shunt coil and that there is, in addition, on the right, a dead resistance, which, however, is used only for starting, and is cut out by a movable core in the solenoid through which the main current passes ; the resistance is therefore only in circuit momentarily, to prevent the great current rushes. By using three such lamps in series instead of two of the ordinary form, the amount of light produced is increased in the ratio of



A Constant Potential Arc Lamp Regulator.

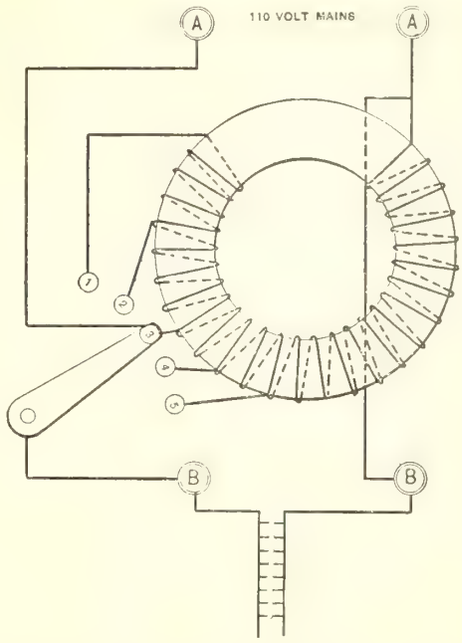
about three to four ; a room formerly requiring 12 lamps will then be equally well lit as far as the amount of light is concerned, by nine of the differential lamps, and, besides this, the amount of energy required will be less. When five or six lamps are connected across 220 volts instead of four, the increase of light is about 25 per cent. In that case it is better to use a dead resistance in each series, but merely for starting the lamps.—American Electrician.

Mr. E. S. Harrison, of Winnipeg, has recently purchased a quantity of apparatus for his electrical testing laboratory.

REMEDY FOR IRREGULAR VOLTAGE.

Mr. Thomas Barnard, of Toronto, sends to the American Electrician the accompanying sketch showing how to overcome irregular voltage, concerning which he says :

It often happens in small central stations that the voltage at the consumers' lamps is very different at different points of the distributing mains; consumers near the station will have a voltage higher than the



rated voltage of their lamps, and consumers remote from the station will suffer from low voltage. In alternating-current plants this irregularity can be easily remedied by installing a simple auto-transformer at the entrance of the low-pressure mains, connected up as shown by the accompanying sketch.

With the switch on button 3, as shown in the sketch, the e.m.f. of the mains will be applied to the terminals of the lamps; moving the switch lever to button 2 or 1 will increase the pressure at the lamps, and moving it to 4 and 5 will decrease the pressure. The one form of apparatus, therefore, is suitable either for places where the voltage is too high or places where it is too low.

The auto-transformer can be easily made by any central-station man. The core can be made up of sheet iron rings such as are used for armatures, and the winding can be calculated by means of the formulas recently given in your lessons department. It is not necessary, of course, to use the exact number of contact buttons shown in the sketch; a wider range of regulation can be obtained by increasing the number of taps. It is only necessary that that portion of the winding between the connections to the secondary of the transformer be calculated for the secondary e.m.f.

THE DODGE CALCULATOR.

We are in receipt of a very ingenious device called the "Dodge Calculator," issued by Dodge Manufacturing Co., of Toronto.

The device is not only a novelty, but it is also an instrument of considerable value and assistance to all mechanics, foremen, superintendents, etc., whose duty it is to figure up speeds of pulleys, gears, etc. We are informed that the Calculator is one of the many uses to which the slide rule principle may be applied.

The Dodge Manufacturing Co. will be pleased to mail the Dodge Calculator free for the asking.

The citizens of Thessalon, Ont., will be asked to vote on the question of installing an electric light plant.

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Correspondence is invited upon all topics legitimately coming within the scope of this journal

The "Canadian Electrical News" has been appointed the official paper of the Canadian Electrical Association.

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Municipal Inconsistency.

IT does not appear to have dawned upon the city council of Toronto how absurd is their position in demanding the repeal of the Conmee Act, while proposing to take advantage of the act to expropriate the gas works.

Canadian Electrical Association.

A MEETING of the Executive Committee of the Association to make preliminary arrangements for the annual convention in Ottawa was held at the Windsor hotel, Montreal, on Tuesday, February 12th. There was a full attendance. It was decided that the dates of the convention should be the 19th, 20th and 21st of June. A committee was appointed to arrange for papers and topics for discussion. A strong local committee was also nominated to make the necessary local arrangements for the meeting, which gives promise of being a most successful one. A number of new members were elected at this Executive meeting.

Supplies for South Africa.

THE quantity of food and other supplies required by the British Government for the South African campaign is enormous. Many classes of supplies, such as canned goods, hay, cheese and bacon, flour and salt, portable houses, wagons, bicyles, axes, etc., Canada could supply, but the bulk of the orders seem to go to the United States. As an example the war office is said to have just contracted with a United States firm for 3,000 axes. We have given British manufacturers a preference in our market, and should have a claim to British orders for products which can be as well supplied by Canada as by the United States. If the British Government are ignorant of our ability to supply many of its requirements blame attaches to the Dominion Government, and no time should be lost in putting before the home authorities the fullest possible information regarding the character and extent of our resources.

Financial Result of the Paris Exhibition.

THE footing up of accounts in connection with the Paris Exhibition indicates that if there be a deficit at all, it will be but a small one, while possibly there may prove to be a surplus—depending upon the willingness of the city to purchase certain improvements of a permanent character on the banks of the Seine. The cost of the buildings and other works was $18,000,000; the expenses of administration $1,700,000; policing, lighting, etc., $2,500,000; "unforseen expenses" nearly $10,000,000; miscellaneous expenses, $250,000, a total of $23,450,000. The receipts from all sources, including subscriptions of $4,000,000 each from the city of Paris and the Government of France amounted to $23,050,000, leaving a deficit of $400,000. This is a much better showing than was made by the French Exhibition of 1878, when the receipts fell short of the expenditure by six million dollars.

Assessment Methods

IF the recommendation of the assessment commission that electric plants be assessed at their actual value be adopted great hardship will in many instances result. When installing these plants, whether for the supply of light power or street railway service, the owners in many cases deemed it advisable to make liberal provision in the way of surplus capacity for future require-

ments. We have in mind an electric street railway which having been built and equipped to provide for a growing traffic, is only now beginning to pay operating expenses, after having been operated for some years at a loss. In all such cases if the recommendation of the assessment commission should become a part of the assessment act, the owners of the plant will be out of pocket as at present the amount of interest on their non-productive surplus capacity, and in addition will be compelled to pay taxes thereon.

The School of Practical Science.

ATTENTION was called in these columns recently to the overcrowded condition of this school, and the urgent need for increased accommodation and equipment. During the present month this need has been forcibly impressed on the attention of the government by a petition presented by the students of the school. The prayer of this petition was strongly supported by deputations representing the Toronto Board of Trade, the Ontario Association of Architects, and the Canadian manufacturers' Association. Emphasis was laid on the necessity of providing adequate educational facilities for the large number of young men who are desirous of qualifying themselves to fill the more lucrative positions in the rapidly developing industrial enterprises of this country, which positions are at present too frequently occupied by graduates of foreign scientific schools. As an illustration of the present overcrowded condition at the School of Science, the fact was mentioned that the present first year class in chemistry, numbering 120 students, had to be divided five times. The Premier admitted that means must be found to increase the accommodation and efficiency of the school, and that at the present rate of expansion a new building would soon be the only remedy. The cost of a suitable building, together with the necessary additional equipment and teaching staff, was placed at about $300,000. The government should seriously consider what action should be taken and from what source the necessary funds could be obtained.

A Dominion Exhibition.

THE Dominion Government is said to have appropriated large sums of money to cover the cost of Canadian exhibits at the Glasgow and Pan-American Exhibitions. A large sum was spent for this object at Paris last year. We are not disposed to question the wisdom of these expenditures. It is good business policy to advertise to the world the character and extent of our capabilities and productions, thereby inducing increase of our population and investment of capital. Why should not this be supplemented by the holding of a Dominion Exhibition in Canada and the effort to induce foreigners to come and actually see for themselves the kind of country we have and the greatness of its resources? We cannot hope to carry out an exhibition on the scale of those held at Chicago and Paris, nor should the attempt be made. Our natural development has reached a stage, however, which should warrant us in entering on an undertaking of this character on a properly proportioned scale. The Dominion Government last year refused to assist such a project, perhaps because of the large expenditure that was felt necessary to secure adequate representation at the great international exhibitions at Paris, Glasgow and Buffalo. Next year when these shall have passed out of sight the subject of a Dominion exhibition should receive practical consideration, and the Federal and Provincial Governments which for many years have been spending money on Exhibitions got up by and largely for the benefit of other countries, should make a liberal appropriation towards a Canadian Exhibitionto be held in Canada, which the mother country, our sister colonies and our neighbors across the line should be invited to visit and send exhibits to. We have the nucleus of such an Exhibition at Toronto, and in connection with the proposal to erect new buildings the larger project should be kept in mind. It is doubtful if the property owners of the city whose approval must be obtained will sanction the proposed large expenditure for new buildings until just cause of complaint with the management of the Exhibition shall be remedied. If the project of holding a Dominion Exhibition in the near future is to be proceeded with it would be desirable to defer action with regard to new buildings in order that a comprehensive scheme adapted to the larger requirements might be formulated.

The Commercial Position of Great Britain.

FOLLOWING closely upon the announcement that Russia has increased its tariff on United States goods, comes a despatch from London that as an outcome of the inroads of American manufacturers upon British trade there is being formed the National Federation of Master Associations and Trades Unions to educate the minds of employees and employers in respect to the expansion of British trade, to devise means to meet foreign competition, to send joint deputations of capital and labor abroad to enquire into the conditions of other countries, and to provide a federation where employers and employees may meet on the same plane. This movement is under the leadership of Mr. John Lockie, late conservative member for Devonport, and is said to have the approval of the present British government.

The United States have not only become a strong competitor for foreign trade of Great Britain and other European nations, but have also invaded the British market, and are securing a large share of the home trade. It is stated that in one industry alone (the manufacture of boots and shoes) Great Britain's trade last year was less by $5,000,000 than in the preceding year, notwithstanding that the firms engaged in this industry are said to be among the most progressive and enterprising in the way of adopting improved machinery and other manufacturing facilities. The American manufacturer takes infinite pains to adapt his goods to the requirements of the particular market in which he seeks to sell, and by liberal advertising and persistent push keeps their merits before the notice of prospective buyers. In Great Britain there are many long established businesses which have descended from father to son. This has in many instances induced the idea that the system of management and character of goods that have been successful for so long a period may safely be continued. Rapid and startling changes are, however, taking place throughout the world, bringing changes in methods and requirements of the people. The nation that studies most carefully these changes, and constantly adapts its products to the new conditions, is the one which will obtain and maintain commercial supremacy. In this regard the United States seem to stand foremost to-day among the great commercial nations of the

earth, hence the strides they are making in the development of their foreign trade.

It is gratifying to note that Great Britain is awaking to the situation and considering ways and means whereby she may hold her commercial position. History has shown that the British people when once aroused are prompt to act for the protection of their interests whether territorial or commercial. Prompt, intelligent and thorough enquiry into the subject of Britain's commercial facilities and relations with other nations would seem to be a present and important necessity, and should be followed by equally prompt, intelligent and thorough reforms in methods, where such are found to be necessary.

The United States exports to Great Britain and Ireland are valued at $600,000,000 per year, while the value of the imports from Great Britain into the United States is but 25 per cent. of that amount. The United States exports to Canada for the fiscal year ending June 30th, 1900, were valued at $109,844,378, or more than the combined imports of France, Australasia, Austria-Hungary and Russia. While profiting so largely by British and Canadian trade, the United States continues to maintain a high tariff wall against these countries. The time seems to have arrived when freer access should be demanded by Great Britain and her colonies to the United States market, and in default of reciprocity of trade there should be a nearer approach than at present to reciprocity of tariffs.

Great Britain has in her colonies commercial allies which as yet she has scarcely taken any steps towards reaping the advantage of, but which, if brought into closer relations with her, would greatly assist in extending and maintaining her commercial supremacy. Canada has shown a desire to enter into such relationship by giving a substantial preference to British goods entering this market. That this action has not resulted in greater advantage to British manufacturers is largely due to the failure of the latter to make their goods better known in Canada, as well as to adapt the goods to our requirements.

Another phase of this question, as seen by an American writer, is presented in the following extract from the Engineering Magazine, of New York: "To the outside world the most impressive lesson of the Queen's death is the magnificent stability of British institutions and the British commercial system. Not a wheel stopped, save as a token of reverence; not a tremor in values disturbed financial centres; not an uneasiness or uncertainty as to national politics caused business undertakings to waver or hesitate. Compare this with the quadrennial upheaval in the United States, where economic legislation of every kind is the football of politics, and industry follows with uncertain feet now artificially raised on an unstable platform of protection, now sinking back from the morass of free silver, certain of nothing but uncertainty with every change of chief executive. The "demise of the Crown" demonstrates anew England's industrial strength, and those who are ready to cry her downfall before her industrial rivals would do well to remember that this stability of commercial organization outweighs much mechanical aptitude. Machinery can be bought, skilful brains and hands can be hired; but stable, political and commercial systems are of slow growth, and not soon attained."

THE CHAMBLY POWER PLANT.

Extensive improvements are being made to the power plant of the Chambly Manufacturing Company at Chambly, on the Richelieu river, near Montreal. Immediately following the recent accident, Mr. J. G. Macklin, chief engineer, commenced operations to restore the working head and to provide for the reconstruction of the wrecked part of the waste gate section. A temporary timber cofferdam has been constructed on the upstream side of the break. It is composed of 16 x 42 foot cribs, 30 feet high, set 12 feet apart in the clear. They have walls of solid dovetailed timber, and were floated into position in a current of about 15 feet a second.

They were filled with rock ballast and sunk on the level rock bottom in about 12 feet of water, after which the 12 foot spaces between them were closed with stop logs. It is not expected that this cofferdam will be perfectly tight, and a second cofferdam will be built inside it to provide a dry excavation in which to build the new permanent dam. This dam will differ in its design from the first one, but its details have not yet been announced. It is of interest to note that originally only one-half of the tail race was excavated, and only to a depth to give 28 feet working head. It soon became evident that a great power development could be profitably utilized, and the second longitudinal half of the tail race was excavated for a head of 31 feet, and then the first half was unwatered and the bottom was excavated 3 feet deeper.

It is the intention, as previously stated, to rewind the present S.K.C. generators, which are at present wound for 12,000 volts, so as to make them work in parallel with new units which are being installed. These new units consist of four 2,000 kilowatts revolving field type, 2,000 volt alternating current generators, with the necessary water wheels and Lombard governors. The power house is being changed from a 12,000 volt direct transmission at two-phase to a step-up installation of 2,000 volts, using two phase on the generators and three phase on the line. This will also necessitate enlarging and re-arranging the sub-station in Montreal to receive the increased output.

The transformers, which will be of 2,750 kilowatts capacity, 3,600 horse-power output, are being built by the Westinghouse Electric & Manufacturing Company. Altogether there will be 20 transformers aggregating 72,000 horse-power. Ten are to accept a two-phase input at 2,200 volts and 8,000 alternations and give out three-phase current at 25,000 volts. The remaining ten are for lowering the three-phase line pressure received at 22,000 volts, delivering two-phase current at 2,400 or 4,800 volts, as required. Each transformer will be 9 feet high and weigh approximately 11 tons. All will be cooled by air from blowers driven by induction motors. The iron and copper have been proportioned to secure an efficiency of over 98 per cent. The Westinghouse process for the manufacture and treatment of the iron to render it capable of high magnetization with comparatively little energy and stable as resisting tendencies to show increased iron losses with service, will be employed. The phase transformation is to be obtained by means of special windings invented by Mr. C. F. Scott, of the company.

It is expected that the power house and dam at Ste. Therese will be completed this year, where it is hoped to develop 10,000 horse power under 16 feet head.

MONTREAL

Branch office of the CANADIAN ELECTRICAL NEWS,
Imperial Building,

MARCH 16TH, 1901.

If the Smith's Falls correspondent who speaks of the fatal accident occurring with 110 volt circuit has an alternating current plant, it may be traced to a parallel instance which occurred not long ago in this city, where the transformer primary was in contact with the secondary and passed to 'ground' through the victim. If his plant is only 110 V. D.C., it seems almost impossible that such could cause death unless the victim was at the time in such a precarious condition of health as to be apt to drop dead at any time.

It seems hardly fair for college professors, who are no doubt well paid, to accept fees for consulting in engineering (electrical) work outside of their college. There are in the advertising pages of the ELECTRICAL NEWS, and also in the daily papers, cards of eminent electrical engineers who make a specialty of just such work, and it is practically "taking the bread out of their mouths." Colleges should realize that this in some cases injures their own old graduates who have in addition to college tuition probably put in some hard practical work also.

In Ontario it appears to be coming quite the fashion for municipalities to appropriate the local electric light plant and run it as a civic or municipal plant. On account of the threatened combine of all the principal illuminating companies (including gas) here, some of our aldermen suggest that the city operate its own plant. Were it operated as economically (?) as some of the Ontario municipal plants, it might possibly reduce what is feared will be the combine's figure, but those who know Montreal's municipal record will greatly doubt this. The contract with the Royal Company, who do the street lighting, does not expire until next year, and it is as yet problematical to what extent the combine will attain and whether or no they will not reduce the figure at present ruling. It would be difficult to find many paying municipal plants in Canada, and Montreal would not be "in it." They have one in Glasgow, Scotland, but it is dangerous there for an official to hold his hand out behind his back, and the last alderman disqualified there met such a fate because he had procured a civic position for his nephew.

Of late there has been considerable complaint as to the quantity of salt used on the tracks of the Montreal Street Railway. The denial of their manager, Mr. Wanklyn, as to any surplus being used was further contested by one of their own shareholders, Mr. H. H. Lyman, in the daily press. The truth of the matter is that both parties are right, i.e., when Mr. Wanklyn or any of his officials are around the amount of salt used cannot be complained of, but when the artist with the long spouted can is left to himself he paces along at a slow march humming "en roulant ma boule," the salt meanwhile gushing forth "ad lib" to form, as it were, an accompaniment to the ditty. For the city, however, to resolve that salt, sand, and even sweepers shall not be used (as they once proposed) would be tantamount to saying "shout down." Some salt is absolutely necessary in Montreal; but judging by the character of the streets, were it not an exceedingly cheap article of commerce the lavish use of it would ere this have affected the dividends.

Toronto is evidently seeking for an opponent to the Bell Telephone Company, in spite of the warning they have had in the federal fiasco here, and in the exceedingly slow progress of present opposition exchange, the Merchant's Telephone Company, Montreal. This business, to be of service, must be a monopoly, and it remains for cities giving franchises to safeguard their interests, get commensurate percentages on income, etc. The Bell Company are adding instruments at an enormous rate here, and are extending by leaps and bounds, at the same time giving an excellent service compared to that in other cities. They certainly make hard and fast conditions in their contracts, but once signed the Bell Company seem to act up to their side of the question. The trouble complaints are promptly looked after, and the long distance service, though expensive, is excellent. On the whole, it is better to be this way than with a couple of mediocre 'phones in one's place of business, both companies cutting rates until neither can afford to give a decent service.

The Terminal Railway Company are seeking to extend their trolley system through Montreal streets. At present they run from Maissoneuve, our eastern suburb, down to Bout de l'isle (end of the island). Although they enjoy a large patronage in summer, it is a question whether their business in winter is a lucrative one, hence, probably, their desire to invade. Although it is not well in some cases to fight for a monopoly, yet in this case the majority of Montreal citizens will feel that they should not be put to the trouble of having more streets tracked simply to suit suburbanites when they have sufficient at present for their own ordinary requirements. McGill College would come under the influence of the current, throwing their delicate instruments out of calibration, and other prominent places voice their protests. Surely for a consideration the Terminal Company could arrange for running rights over the Montreal Street Railway Company's tracks. However, it looks at present as if the Terminal Company will eventually gain their point with our city council.

THE LACHINE RAPIDS HYDRAULIC AND LAND COMPANY.

From the annual report of the directors of the Lachine Rapids Hydraulic and Land Company, of Montreal, presented at the annual meeting held last month, it is learned that the net profit for the year 1900 was $84,546.30. From this amount dividends were paid at the rate of 4 per cent. per annum for six months ending June 30th, and at the rate of 6 per cent. per annum for six months ending December 31st.

Many improvements were made during the year. The wing dam was raised above flood level for a distance of about 3,300 feet. The object of this was to do away with the overflow of the dam, thereby decreasing the current at the intake and saving the timber dam from being damaged by ice, and at the same time providing a deep channel in the tail-race for winter use and causing all the water used by the wheels to be discharged on the shore side. Among the improvements to the power house was the installation of new governors of improved type, with two additional governors for operating the exciter-wheels, also four new generators of 750 k.w. capacity at normal load. In the sub-station there were installed ten 250 k.w. air-blast transformers, complete with blowers, and a marble switchboard.

Property was purchased adjoining the sub-station on which to build a fire-proof transformer house during the coming spring, and it has also been decided to construct a duplicate pole line to the Rapids.

There were purchased during the year meters costing a total of $7,641,57, making the total number of meters in use at close of the year 2317. The net increase of equivalent 16 c. p. incandescant lamps added to their circuits during the year amounted to 15,376, making a total of 71,500 lamps connected, in addition to 205 arc lamps on flat rate. The power in motors connected to circuits during the year amounted to 1,548 h.p. In this estimate is not included some 1,300 horse power which is being supplied to another company for emergency purposes.

THE PETERBORO WORKS OF THE CANADIAN GENERAL ELECTRIC COMPANY.

During the past year extensive additions and improvements to the Peterboro works of the Canadian General Electric Company have been made. The new building erected includes the business offices and an immense modern manufacturing shop. The office building is two stories, commodious and well equipped, and finished in natural oak. The lighting of the office is by arc lamps of a handsome pattern.

The new factory is a modern manufacturing building, with gallery, the entire height of the interior being unbroken save for a spacious gallery about 25 feet wide that skirts the entire interior at a height of 15 to 20 feet from the main floor. The factory is 280 feet long and 100 feet in width. It is of brick and steel, the massive steel pillars and the strong steel girders forming one complete frame, in nowise dependent upon the masonry, but capable of standing quite separately from such. Running the entire length of the building is a crane track supported by steel pillars, upon which is operated a forty ton crane. By a system of fire protection the entire roof sheeting can be instantly soaked with water by means of small pipes projecting beneath the roof at right angles from larger conduits. In the western wall of the addition has been constructed three furnaces, or kilns, which are intended to abstract all moisture from armatures or coils. It is proposed to have the armature, testing and transforming departments occupy the ground floor of the new building, while the tool and brass departments will probably be installed in the gallery.

QUESTIONS AND ANSWERS

"Superintendent" writes: We have some cars on our road equipped with K2 controllers, and I would be glad of any directions you can give me for keeping them in good shape. What is the best way to stop the use of the shunt on the last step, which is a faster speed than we need? Shall I open-circuit the wires leading to it?

Ans.—The first essential for the care of these controllers is the same as for any other electrical appartus, viz., keep them absolutely clean; have the tension springs adjusted so that the fingers press on the cylinder hard enough to prevent all chances of arcing, yet not too tightly, or else they will cut. A very little lubricant may be occasionally rubbed on the various contacts of the main cylinder, though none is necessary on the reversing fingers. All lumps caused by any unusual arcs must be filed off and the fingers of the main cylinder adjusted so that wherever two or more of them make contact on the same step, they all touch simultaneously. This will divide the arc among all the fingers so that each takes its proper share, otherwise one finger may be opening the circuit in front of the others on the same step or position, which results in badly burning the insulating arc deflectors placed between them and perhaps in a short circuit between fingers or a ground to the case. The best way to open the shunt circuit is to take off the shunt contact pieces on the parallel side of the cylinder; you will find them held by a single screw each, they are the two pieces which raise the shunt fingers when the controller is put on the last step. You can, of course, cut the wires which lead to the shunts, or take off the shunt fingers, but either of these two latter methods will cut the shunt out on the series as well as the parallel position, and thus give a somewhat more jerky acceleration of your car than would otherwise be obtained.

"L.G.H.," Newmarket, Ont.: I am thinking of puting in electrical power in my printing office to be supplied by the Street Railway Co., and I wish you would give me your opinion on the following questions:

(a) Do you consider power from the Street Railway would be satisfactory? I want to use power for Monoline typesetter, which is calculated to run with ⅙ of a horse power. This machine is supposed to run 8 hours per day, and I could attach a small press to the same shafting. The other machinery could easily be run by a 3 horse power motor. In fact, I run everything now with a 3 horse power gasoline engine all at once.

(b) What should I pay for current per year to run a ½ horse power motor for the Monoline typesetter and a small press, and do you think that the fluctuation in the current would cause any trouble?

(c) Would you advise me to put in 4 horse power motor to supply power for all the machinery, since I don't use the full power only about 6 hours per week?

(d) Would the fluctuation of the current have any effect on the life of the motor? I hear that one man in North Toronto tried power from the Metropolitan Railway, and he was troubled with the fuse burning out every little while when the power went down. He was using a 6 horse power motor. Do you suppose that would be the case if I used a 4 horse power motor? Do you know of any office using current from a street railway plant?

Ans.—(a) It depends entirely upon the voltage regulation obtaining on the particular road you have in mind. The pressure on street railway circuits, especially those of small roads, varies considerably, producing a corresponding variation in the speed of the motors connected to it, and it is a question which can be decided by no one but yourself, as to whether the speed variation caused by this is permissible in your work or not.

(b) About $30 to $50 per horse power year of 10 hours per day, 6 days per week.

(c) No; keep the size of the motor down as much as possible consistent with safety, that is, if 3 horse power will drive all your machinery, when everything is running simultaneously, and you use this amount for only 6 hours per week, which we presume means an average of one hour per day, we would think that a 2 or 2½ horse power motor, if of a good type, would be quite sufficient for your needs.

(d) Variations in the voltage should not injuriously affect the motor unless it rose to an extremely high point, say 600 or 625 volts for a 500 volt machine. If you use the proper kind of starting rheostat you should experience absolutely no trouble beyond the speed variation due to the fluctuations in the voltage. The size of the motor would not make any difference. We do not call to mind off-hand any printing offices operated off street railway circuits, though of course there are numbers of stationary motors operating various kinds of machinery supplied by current from this source.

We presume you have looked into the question of insurance, the underwriters usually objecting to any wires connected to a grounded circuit such as a trolley line being taken inside of or even on to buildings on which they are carrying a risk.

"Dynamo Tender" writes: I am operating a generator which was sold to me as a 500 lighter, which I figure ought to give 20 lights to the ampere, while I am only able to get 15 lights to the ampere. How could we find out the capacity of the machine? For some weeks past I have not been able to get the machine to pick up the current promptly at the start. I have gone over all my connections, tested my machine for a ground. There is a single pole exciter, but no brushes on the machine. When the current starts she will run all night without a spark.

Ans.— There are several points which would affect the case in question. One is the voltage at which the machine would be operated; of course, the higher the voltage in the lamps the more lamps of 16 c.p. you will get to the ampere. The results also would depend very much upon the efficiency of the lamps. Supposing the current is transformed in a ratio of ten to one, the voltage of the machine being 1,100 and the efficiency of the lamp 3.5 watts per candle, this would give 19 lamps per ampere of the primary current. This would be the theroretical result without considering loss in line and transformers. Without further information on these points or a test of the dynamo it will be impossible to say just what its capacity is.

"Subscriber": I have several long burning arc lamps on 110 volt D.C. current, and I have been having trouble with one of them. It will burn 10 or 15 minutes, then blow the fuse. It cannot be a short circuit or it would

blow the fuse at once, would it not? It has been burning all right until just lately. What do you think the trouble is?

ANS.—Your trouble may be due to a variety of causes, and it is extremely difficult to say just what part of the lamp is out of adjustment; possibly the clutch is slipping and not picking up the carbon promptly enough, or the coil may be partially short circuited, as also may be the case with the resistance. Have you examined the fuse and its holder thoroughly; any bad connection round it would tend to materially lessen its carrying capacity and make it blow at a current much below the normal. If you find nothing wrong after going over everthing carefully, we would feel inclined to try a larger fuse. Lamps of this character, burning normally with about 5 amperes, require usually from 15 to 20 ampere fuses.

"R. T." writes: I am thinking of putting up a transmission line for my factory here, and would like your opinion as to whether it is advisable to put up a barbed wire as a lightning arrester.

ANS.—At one time it was thought that barbed wire made a good arrester and that its use was almost a necessity on any long lines, but the experience of the last few years has tended to very much reduce its use, it having been found to be the source of much trouble from rbeaks and the consequent short circuiting or grounding of the main wires. It undoubtedly is a good arrester when properly put up, but no matter how well the work is done, it is found that breaks will occur very frequently, entailing numerous shut-downs, and the latest modern practice seems to favor the use of the ordinary arrester installed at frequent intervals along the line.

"H. L.," Montreal, writes: I understand that some roads are using the Canadian General Electric Company's K10 controller for 4 motors, but have always understood that it was built for two motors only, and would be glad of any information you can give me.

ANS.—The K10 controller is rated by its manufacturers as capable of controlling two 35 horse power 500 volt railway motors, or as having approximately a capacity of 150 amperes at 500 volts. Now, if the combined capacity of the 4 motors does not appreciably exceed the above controller rating, no difficulties from abnormal arcing or excessive heating need be anticipated, but owing to the reversing switch being provided with contacts for but two motors, it becomes necessary to group the 4 motors into 2 groups, each consisting of two motors with their field coils permanently in parallel, and also their armatures, instead of having the wiring of each motor completely separate from that of the others. This method of connecting generally results in the work and current being very unevenly divided among the motors, and consequently in a great increase in motor troubles and the repair bills therefor, and is not, to say the least, a practice to be recommended.

Mr. Mannel, of Burford, Ont., contemplates putting in an electric plant.

Montreal capitalists, under the name of the Trinidad Electric Company, have obtained control of the existing tramway lines and lighting plant in Port of Spain, Trinidad, and are about to convert the tramway to an electric system and extend the lighting plant. Those interested included Messrs. W. B. Chapman, A. F. Gault, F. Wanklyn and others of Montreal, and B. F. Pearson and David McKean, of Halifax.

CORRESPONDENCE.

THE DESIGN OF TURBINES.

QUEBEC, March 1st, 1901.

Editor CANADIAN ELECTRICAL NEWS:

DEAR SIR,—Your short editorial upon the above subject in last month's issue of THE CANADIAN ELECTRICAL NEWS opens up a question of great moment. The development of water powers in our country can scarcely be said to have begun, in the way of the development of high heads particularly, and your timely suggestion that this class of hydraulic work should be studied by Canadian manufacturers, is appreciated in not a few localities.

The designing of turbines in the United States and Canada has not been carried on in the same way as say steam engine work, for broadly speaking, there is as much difference between the methods of designing engines and turbines as there is between day and night. In the first case, designing has been along the line of results afforded by means of well developed experiments. In the other case, it has been purely empirical, perhaps not even that in the vast majority of cases; it could be better expressed by the term "cut and try method," or the vigorous application of the drawknife, a little off here and a little off there, and another amaturish test made of the turbine, that in its local sphere of manufacture can lick anything on earth, and give the Dutchman's percentage.

Most American turbines have been developed by unscientific mechanics, and any advance made has been due solely to the advantages afforded by Holyoke testing flume. An unfortunate feature about Canadian made wheels is the unwillingness of manufacturers to submit their work to test, not simply placing their wheels in the same flume with one of foreign make, and because they may both be styled the same number of inches in diameter; and further, if the home manufactured wheel develops more power than the foreign made one, a great noise is made about same, and yet no one has any knowledge of the venting powers or the co-efficiencies of efficiency of either the one or the other.

The diameters of turbines as catalogued to-day is a misnomer. Take one and all of the catalogues published and figure out the co-efficiency of speed, and the variation will be from 65 per cent. to 90 per cent. and upwards that of the theoretical starting velocity of the head under which they are tabled. Why is this? In engine work you can design for any given piston speed. And yet turbine builders do not know for a surety what speed they will obtain should they change the discharging angle of the buckets; that can only be obtained by test.

Until we come at the methods of designing turbines known to continental hydraulic engineers, it is not much use of Canadian builders attempting to build for high heads and guarantee an efficiency approaching 80 per cent. Constructing turbines for high heads of say over 50 feet is an entirely different matter to that of supplying wheels for medium heads of say 10 to 25 feet. Now, most turbine builders believe that they have secrets about their wheels both as regards the design and manufacture that they keep to themselves because of a supposed pull it gives them to secure contracts over the heads of their competitors in the business. Now, take it all in all, the diversities of gate arrangements, the various forms of buckets, with flaring discharges, corrugated receiving edges, projections upon the faces of the buckets, inward discharge, outward discharge, downward discharge, and all other known ways of discharging water through a turbine; if they were one and all taken as wheat is taken to winnow the chaff from same, some good ideas might be obtained which would be of use to the turbine designer, not the man who with drawknife may form a turbine bucket, but to the one who over the drafting board designs turbines, and who is supposed to have more than an elementary acquaintance with the torricelliam theorem or any hydraulic formulae, then we might hope to be able to build home made turbines unequalled anywhere. I look for that time. I believe that Canada has the greatest water powers on earth, and there is no question that the time is close at hand when Canadian manufacturers will be able to produce the article. I have only written in a general way, perhaps not affording even a good thought to the subject, but I have done so solely because of my interest in the subject and to thank you for calling attention to the matter.

Yours truly,

"TURBANUS."

The Glen Tay Power Company, of Perth, Ont., has been organized with Hon. J. G. Haggart as one of the directors.

ENGINEERING and MECHANICS

CHIMNEYS AND STACKS FOR STEAM BOILERS.

By W. H. Wakeman, in Modern Machinery.

The statement that a chimney or stack is necessary to create draft under a steam boiler, except where forced draft is used, will occasion no surprise, because it is a self-evident truth. But all of the necessary appliances are not equally efficient, and in some cases the cause for the deficiency may be easily traced out, while in others it requires careful investigation in order to locate the trouble.

The theory of the cause for draft in a chimney is well known, but no other theory in relation to engineering is more persistently doubted, by the "practical" man, and there are not sufficient causes to warrant this continued opposition. I have never met a man who doubted the theory and could substitute a better one for it; the large majority of unbelievers do not attempt it.

This theory is as follows: Currents of air vary in density, consequently the more dense parts seek the lowest level, while the lighter parts rise as high as possible. As the lighter parts rise the heavier parts are drawn in to take their place, and if this process takes place in a chimney, and the only entrance to the base of it is through the furnace of a steam boiler, a draft will be created, the force of which will depend upon the comparative density of the air, and gases inside and outside of the chimney, and for convenience sake this force is measured in inches of water.

From this it is evident that the lighter the gases are in the chimney the stronger will be the draft, so that while a high temperature of escaping gases denotes that much of the heat in the coal burned has not been absorbed by the boiler, and hence is at least a partial loss, the draft is increased over what it would be with a lower temperature; therefore, more power can be developed by the plant.

In many cases chimneys do not give as much draft as they were expected to, and are therefore considered detrimental to the economical combustion of the coal burned, and are condemned by the engineers in charge. The objects sought in writing this article, are to point out some of the causes that are responsible for this undesirable state of affairs, in order that the blunders made may be rectified in the best way, while others may profit by the suggestions here offered and avoid future failures along this line; also, to show that the problems of chimney design are not as complicated as certain mysterious formulas used in this connection, in works on the subject, would naturally cause us to believe.

In many cases the surrounding objects will determine the necessary height of chimney, for it would be a mistake to erect a chimney 100 feet high near a building that stands 125 feet above the ground, as the draft would be poor.

For the purpose of illustrating the rules to be given and explained, I shall assume that the chimney is to be 144 feet high, the temperature of the air 60° Fah. and of the gases 500° Fah.

The draft will be determined by the difference in the density of the air and the gases, and by the height of the chimney. The density will vary as the absolute temperatures, and for the air it may be determined by dividing the absolute temperature of melting ice by the absolute temperature of the air, and multiplying quotient by .0807. As the absolute temperature of a body or of gas is 461° more than its temperature by the thermometer, it is 32 + 461 = 493° for melting ice. The absolute temperature of the air is 60 + 461 = 521°.

Then 492 ÷ 521 × .0807 = .0763.

The density of the gases is found by dividing the absolute temperature of melting ice by the absolute temperature of the gases, and multiplying the quotient by .084. Then 493 ÷ 961 × .084 = .0430.

Using the foregoing data we can determine the draft in inches of water by subtracting the density of the gases from the density of the air, and multiplying the remainder by .192 and again by the height of chimney in feet. Then .0763 — .0430 × (.192 × 144) = .92 inches of water.

I have given this example because it explains the process, but where no explanation is desired the following rule may be used, as it gives nearly the same result. Divide 7.66 by the absolute temperature of the gases and subtract the quotient from .0146. Multiply the remainder by the height of chimney in feet. In this case it is 7.66 ÷ 961 = .00797, and .0146 – .00797 × 144 = .95 inches of water.

For the same temperature, the draft for any other height may be found by proportion, as it varies with the height. For a chimney 200 feet high it is as follows: 144 : .92 : : 200 1.27 inches of water.

Disappointment is the result of expecting that the actual draft will equal this, as it will not; and yet the calculation so far given is correct, but no allowance has been made for the friction of the gases as they pass upward through the rough and sooty chimney or stack, and for ordinary cases; 10% should be deducted for this, which leaves .93 inches of water for the first illustration given.

Where we need the draft at the grate where the fuel is burned, and between this and the chimney, the passageway contains several obstructions in the form of a contraction at the bridge wall, where tubular boilers are used, a return bend in the combustion chamber, a division of the current when passing through the tubes, a right angle turn at the front end of the boiler and another one when the nearly horizontal flue is reached, and perhaps one or two more before the chimney is reached. About 25% reduction must be made for these, leaving an available draft of .93 – (.83 × .25) = .63 inches of water, and where several boilers are connected to the same chimney, it may be expected that some of them will realize more of the draft than others. These rules for chimney draft are based on the assumption that the gases maintain a uniform temperature throughout their ascent through the shaft, but this is not true in practice, for as they travel farther away from the boiler, the temperature is reduced, thus bringing the density of them nearer that of the outer air. This will detract from their drawing power, and still it must be remembered that as the temperature is lowered, the volume is reduced, so that one tends to offset the other.

As already mentioned, some men dispute this theory, and, as evidence in their favor, point to the fact that a chimney will draw when there is no fire to heat the air in it. This is not strange, for in many cases it is heated by natural means, which answer every purpose. If the sun shines on an iron or steel stack, the internal air is warmed more than the outer, and draft is created. Even when the sun does not shine on it, the inside of the shaft is not exposed to the wind, hence it may be much warmer that the wind that blows against the outside of it.

Draft does not exist in all chimneys when cold, for I have had to build a fire at the base of the shaft, or in the breechen of the boiler, on several occasions in order to make the chimney carry off the smoke of a fire on the grate.

It is not a difficult matter to measure the draft of various chimneys, and note the results, taking their height and other conditions into consideration, when it will be found that sometimes a high chimney will give no more draft than a lower one does in another locality, but in all such cases there is some reason for the results; although it may not appear on the surface. A few years ago much was written concerning the great advantage of having a chimney flue larger at the top than at the bottom, and apparently very good reasons were given for the plan, but where one built in this way did give good results, we were never sure that some other condition was not responsible for the desirable condition of affairs.

I never knew of but one case where a stack that was larger at the top than at the bottom was taken down and reversed. This was of much interest, because it was set up again in the same locality, and the same boilers were used. After the change, there was not enough difference to be perceptible in every day service, but a carefully graduated draft gage showed a slight improvement with the small end of stack uppermost. As already observed, the ascending gases become cooler, and hence are reduced in volume, and therefore there is no logical reason for the top being the largest.

It is important that we know the amount of coal that it is possible to burn in one hour on each square foot of grate surface, and for making this calculation Prof. Thurston gives the following rule: Multiply the square root of the height by two and subtract one from the product. In this case it is 23 pounds.

Now I have no doubt that this rule is correct, for it is based on the results of experiments made, and it can be, and is done in every day practice, but it results in a lower efficiency than can be

secured by a slower rate of of combustion, and where this rule is applied to lower chimneys with feebler draft, in order to burn the coal it calls for, it becomes necessary to "break the fire up" at short intervals, where bituminous coal is used, and every time this is done some of the good material is lost through the grates, and there is no help for it. When anthracite coal is used, the fires must be cleaned often, which results in a direct loss.

If a mechanical engineer should design a plant with the expectation of burning this amount of coal for ordinary service, it would be a great mistake. I would reduce it by 40%, making it 13.8 pounds, as that is the most that should ever be burned, and when the load is lighter (as it varies in almost every plant), the amount would be less. Still, this would admit of an increase for short periods without serious detriment. It is proper to make the area of a chimney large enough to burn the maximum amount of coal that can be used on the grate, and then it can easily dispose of the smoke and gases resulting from any smaller quantity. This makes it necessary to know the number of square feet of grate surface, and for illustration it is assumed that there are three boilers, each having 30 square feet of grate surface. We then have 90 square feet, and 23 pounds for each, or 2,070 pounds per hour as the maximum quantity that can be burned.

The area of chimney in square feet is found by dividing the pounds of coal burned per hour by the square root of the height, multiplied by 12. In this case it is $2,070 \div 144 = 14.4$ square feet.

The diameter of a round flue that will contain this area is found by dividing by .7854 and extracting the square root of the quotient; $14.4 \div .7854 = 18.5$, the square root of which is 4.3 feet. If a square flue is wanted, it should not be less than four feet, because the corners are of little value, for the friction of the gases as they ascend in these parts is excessive, hence they may be ignored in a case like this. The horse-power of boilers that may be operated by this chimney can be determined by dividing the coal burned by 5, and $2070 \div 5 = 414$ horse-power.

The allowance of five pounds of coal for a horse-power may be considered excessive, but it is customary to make this allowance, in order to be on the safe side. Automatic engines require less than this as a rule, but pumps require much more.

If it is desired to calculate the required area of flue by the horse power of chimney, it may be done on the same basis, by dividing the horse power by .2 of the height. Applying it here shows that the area is $414 \div (.2 \times 144) = 14.4$ square feet. It is much better, however, to calculate directly on the amount of coal burned.

I am convinced that some reader will look over these calculations, and then find one or more chimneys that are not as large as they call for, so that a text will be afforded for another sermon on the difference between theory and practice, but I will make such investigations unnecessary by saying that I know of such cases right in the vicinity of where this is written, but they prove nothing against theory. If it could be proved that the best results are secured where such monstrosities are in use, then theory would have to be discounted, but as this is not done it will have to stand approved. I will mention the essential features of a case with which I am well acquainted. The horizontal flue leading from a battery of boilers to a chimney is of the right size to suit the capacity of the steam generators, but the chimney area is only a trifle more than one-third of the flue area. This plant is run nearly every working day in the year, but an investigation of the practical results, and an interview with the engineer in charge, would convince the most skeptical that there is chance for much improvement.

In another case the brick chimney of a small plant did not give satisfaction and the owner put an iron cap on the top of it in which was a hole smaller than the conditions called for, and over this was erected an iron stack, which showed that the designer believed in having it high enough, but cared nothing for the area.

A certain class of objectors claim that it is not necessary to have a strong draft because the damper regulator is shut for a portion of the time, so it is just as well to have less draft, and let the damper be open for a greater portion of the time. This is a mistaken idea, for the fire should burn briskly while the draft is on, and when the required steam pressure is secured, it should be shut off until the pressure is slightly reduced. A good damper regulator will attend to this duty in a perfect manner. The philosophy of this is that while the draft is strong the combustion is more complete than when it is feeble. Another reason is that under these conditions much of the soot is swept through the tubes, instead of being left in them; consequently the boiler gives better results from the fuel burned under it.

In some cases it may be convenient to know the power of a certain chimney to burn coal, as for instance where an old chimney is to be used for a new plant of boilers, or where a new chimney of a given size may be desired. This may be determined by multiplying the area in square feet by 12 and the product by the square root of the height. Suppose that a chimney is 120 feet high with a round flue five feet in diameter. The area is 19.6 square feet, and the square root of height is 11. Then $19.6 \times 12 \times 11 = 2587$ pounds per hour.

According to a rule already explained, a chimney 120 feet high will burn 21 pounds of coal per hour on each square foot of grate. By dividing the total weight burned, by the latter, we find that the chimney will furnish draft for $2587 \div 21 = 123$ square feet of grate, and for four boilers it will be 31 square feet for each.

I have noticed that in several cases where chimneys have not given satisfaction, they have been built higher in order to increase their capacity. This is good practice, but I wish to call attention to the fact that while the force of the draft increases directly as the height is increased, its capacity for burning coal increases only as the square root of the height. This is an important point, for if it is not understood, disappointment may result, where an addition is built on to a chimney. If a chimney 80 feet high does not give sufficient draft, and it is possible to build it 80 feet higher, the force or intensity of the draft should be very nearly doubled.

To conclude that it will be possible to burn double that amount of coal with it, would be a great mistake. Each pound of coal requires a certain amount of air for its combustion, and the amount passing into the furnace of a boiler will, of course, depend upon the rate at which it travels. Now the intensity of the draft denotes the pressure that is forcing air into the ash pit and up through the grates, but if this force is multiplied by two, the speed will be increased as the square root of two, which is 1.44. It follows as a natural consequence that if it is necessary to double the amount of coal burned, the height of chimneys must be multiplied by four, and if great exactness is desired, enough more must be added to overcome the friction of the increased length of shaft.

A few years ago, if I had been called upon to decide whether to use a brick chimney or an iron stack, I should have favored the brick structure without hesitation, because iron stacks were proving failures after a few years of service, while bricks and mortar were not ruined by the different kinds of gases traveling upward, and were affected little by the rain travelling downward, while a coat of paint every year or two was not neeessary.

Conditions are somewhat different now, for steel has replaced iron, proving much more durable, while improved methods have made it possible to erect these stacks and keep them in place during heavy gales without guys of any kind, so that as far as present experience will warrant an opinion, the two kinds are about on a par.

Before closing this article I wish to correct a mistaken idea that is often expressed by thoughtless people concerning the cause of a poor draft on some days where it is usually very good. Whenever the smoke curls lazily out of the chimney, and then seems inclined to come down to the ground instead of going into clouds, the remark is made that the draft is poor because the air is "heavy." If this is disputed, attention is called to the fact that the smoke comes downward, as truth of the proof of it.

The foregoing calculations concerning chimney draft were made with the assumption that the barometer stood at a certain given point and that the density of the air would correspond. If the barometer shows that the air is indeed heavier than the standard taken, the difference between the density of the air and of the gases will be greater, hence the draft will be stronger and not weaker. On the other hand, if the barometer shows the air to be lighter, the comparative density will be less, and as a natural consequence the draft may be less, in direct contradiction to the popular expression.

ENGINEERS' AT-HOME.

The At-Home of Toronto No. 1, C. A. S. E., which was held in the Confederation Life Building on the evening of February 14th, was characterized by the same large measure of success which is common to similar events of this association. The large hall was appropriately decorated. Mr. James Huggett presided at an excellent musicale, at which the contributors were Miss Coutts and Messrs. Maguire, Gillogly, Smith and others, Miss McKay being the accompanist. Dancing followed, and was apparently thoroughly enjoyed. A splendid supper was furnished by Caterer Jacques. The committee in charge of the entertainment comprised Messrs. C. Moseley, president, J. W. Marr, secretary, A. J. Butcher, A. M. Wickens, E. J. Philip, Jas. Bannam, G. C. Mooring, N. Kuhlman, S. Thompson.

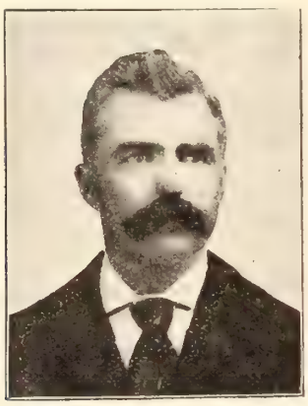
ELECTRIC RAILWAY DEPARTMENT.

MR. DUNCAN McDONALD.

Many persons identified with street railway matters will recognize in the accompanying portrait the features of Mr. Duncan McDonald, late superintendent for the Montreal Street Railway Company, who recently went to Paris, France, to become general manager of the Compagnie Generale de Traction. Mr. McDonald had been connected with the Montreal Street Railway for over twenty years, and is well known to the street railway fraternity. Before leaving Montreal he was tendered a banquet by the officials of the company and presented with an illuminated address and a well filled purse by the employees under his superintendence.

Mr. McDonald states that in France electricity as a motive power is yet in its infancy. A number of electric lines have been constructed in Paris, but so far few of them have been operated; they use what is known as the diatto compact system.

Mr. McDonald will have associated with him in his new field Mr. Nelson Grayburn, formerly electrical engineer for the Montreal Street Railway Company, but latterly superintendent of rolling stock with the Corporation Tramways, of Glasgow, Scotland. These gentlemen will no doubt introduce vast improvements to the street railway system of the French capital.



MR. DUNCAN McDONALD.

THE ELECTRIC STREET RAILWAY OF GEORGETOWN, DEMERARA.

To Canadian capitalists is due the credit of having provided modern electric street railway systems for the cities of Kingston, Jamaica, and Georgetown, Demerara. The prime mover in these undertakings was Mr. W. B. Chapman, of Montreal. In a recent issue of the Street Railway Review some interesting particulars are given by Messrs. N. Swan and N. S. Rankin regarding the construction of the system at Georgetown, British Guiana, a city with a population of 60,000.

In the summer of 1899 Mr. Chapman was successful in securing the necessary franchise, which was immediately financed by a Canadian Company, with Sir William Van Horne at its head. The Georgetown Tramway Company and the British Guiana Electric and Power Company were purchased and united under the style of the Demerara Electric Company, Limited. Amongst its officers are Sir William Van Horne, B. F. Pearson, of Halifax, and W. B. Chapman and Ernest Alexander, of Montreal, the last-named gentleman being secretary of the company.

The construction of the road was carried out under the superintendence of the late Frank P. Btothers, who was manager of construction for the Kingston, Jamaica, electric road. Many difficulties of construction were encountered, such as the intense heat and glare of the sun, the slow and uncertain arrival of goods, and heavy tropical rains and storms. At one time during the construction there was not one period of twenty-four hours passed in ninety-two days that some time rain did not fall; and before resuming work after a cessation of rain it was necessary to bale the water out of the trenches which had already been cut and prepared for receiving the rails.

Nearly everything for construction purposes had to be imported into the colony, and the failure of contractors to ship materials on specified dates greatly hampered the rapidity of construction.

The system consists of 10.2 miles of track. A 62-lb. steel T rail was used, with girder rails at curves and switches. Both straight track and special work were supplied from the United States. The rails are set on concrete stringers 22 in. wide by 10 in. deep, with steel ties 10 ft. apart.

The overhead construction is single No. 0 copper, with Heckla bronze insulation as supplied by the Albert & J. M. Anderson Co. Iron tubular poles set in concrete support the feeder and trolley wires, and as the company controls both the private and public lighting of the city, these wires are also being transferred to the iron poles, and the old wooden ones removed. Both bracket and span wire is used in different portions of the city. Mr. J. W. Morris, of St John, N.B., who has had a large experience in Canadian and American cities, as well as in the tropics, had entire control of this branch of the work.

The company commenced to operate with 14 open cars made by the St. Louis Car Company. These are 8-bench cars with reversible seats, monitor top and bonnets, end bulkheads with glazed sash and double thick glass, revolving signs, etc. They are handsomely painted and decorated, and are fitted with Providence fenders. The electrical equipment consists of a Westinghouse No. 12A, 30 h. p., 500-volt, slow-speed single motor, with G. E. controller R-17. As there is hardly a grade in the whole city, cars should be operated at a very small cost.

The existing car sheds, with alterations and additions, have been transformed into first-rate car barns. In accordance with the style of building most in vogue in the tropics, they are open, and have a capacity of 16 cars. Four tracks run into the shed, which has also pits and machine shop. There is additional space for three other tracks when required. A part of this building is devoted to storerooms. Outside are three tracks on which cars can be run on emergency, or stored there at will.

The power station, which has been built for some years and was originally the property of the British Guiana Electric Light & Power Co., has been thoroughly overhauled and reconstructed by the present company, which has also put in two additional engines and generators for railway work and the supplying of power. The franchise of the company gives it the exclusive right to make and supply electricity for the term of thirty years.

with renewal features which make it practically perpetual. The original station comprised a duplicate plant for lighting purposes, consisting of two vertical and three horozontal engines giving a power supply of about 800 h. p. These have batteries of Babock & Wilcox and Stirling boilers, which are also in duplicate, and suffice to supply steam for the two new engines installed.

These new engines were supplied by the Robb Engineering Company, of Amherst, N. S., and comprise one 200 h. p. direct-connected, tandem-compound engine and one 200 h. p. belt-connected, tandem-compound engine. The two latter engines and generators suffice also to form a duplicate plant for railway purposes. It is the intention of the company later on to extend the lines into the suburban districts, which are thickly populated and give promise of good traffic.

THE NELSON ELECTRIC RAILWAY.

Within the past year the Nelson Electric Tramway Company, an English company organized by Mr. W. H. Drummond, obtained a charter from the city of Nelson, B. C., to operate an electric railway. Up to the present about three miles of road have been completed, but we are told by the Journal of Electricity that it will probably be extended to some of the suburban mining camps. There are three cars, each equipped with four G. E. 1000 motors, controllers and brakes. The grades are very heavy, maximum 17 per cent., and the cars, especially on Sunday, are generally heavily loaded. After considering the question of motive power, the company finally concluded to give the West Kootenay Power and Light Company, of Rossland, the contract for supplying 500 horse power, to be transmitted electrically from the generating station at Bonnington Falls, on the Kootenay River, a distance of 12 miles from Nelson.

The West Kootenay Power and Light Company's sub-station in Nelson closely resembles the one in Rossland, as does also the Nelson pole line, but the latter was not roofed as was the Rossland transmission pole line. The two lines are of No. 8 B. & S. hard-drawn wire, and supported throughout on porcelain triple petticoat insulators of Redland's type. The lines pass through the end of the sub-station, where the usual equipment of choke coils and lightning arresters is placed, to a high-tension switch-board consisting of two blue Vermont marble panels, each mounted with a double-throw, quick-break switch, and containing the usual facilities to afford safety and celerity in the handling of both the lines and banks of transformers. For instance, both lines can be fed into the same transformer, or, to make still better regulation, one bank of transformers can be fed from one line for the railway load, leaving the other line and bank of transformers for the lighting load. The latter are of the usual air-blast type. The primaries take either 9,600 or 16,000 volts, according to whether connected in delta or in star, while the secondaries deliver 2,200 volts.

The three-phase current at 2,200 volts is led direct through the low-tension switchboard to a Canadian General Electric revolving field 350-kilowatt synchronous motor, the designation of which is "A. T. 18, 350, 400, 2200, and which is directly connected to a 325 kilowatt direct current generator on the same base. The designation of the latter is "M. P. 6, 325, 400, 550." This generator furnishes direct current to the railway. The switchboard at present is a three-panel one. The railway generator panel is of the customary type, with a large Weston station voltmeter swung to the side, and is provided with a magnetic blow-out circuit-breaker at the top of the panel.

The synchronous motor panel is similar to the machine panels at the main plant, being equipped with a Thomson alternating voltmeter and three ammeters, oil-break switch, "I. T. E." circuit-breaker and field rheostat.

The thiid panel is one on which is mounted a synchronizing device, exciter ammeter, field rheostat, and a special switch for the 30-horse power starting motor, which is located on the base of the motor generator, set and connected by a gear and clutch to the main shaft. This starting device has proved very successful.

All track through the city is laid with 72-lb. T rails on cedar ties. The rail joints are bounded with 000 rail bonds, and cross-bonded at frequent intervals. All poles are of cedar, overhead construction being supported by G. E. apparatus. The trolley wire is No. 0, fed at frequent intervals from a No. 00 feeder.

ELECTRIC RAILWAY ADVANCEMENT.

One of the most interesting phases of the almost phenomenal increase of electric street railway mileage in this country, has been the corresponding increase in the amount of riding solely for pleasure, or as it might be called, the artificial traffic. Not over two or three years ago it was an open question, says the Street Railway Review, whether street railway companies could profitably invest money in parks and amusement attractions, whereas to-day there is hardly a road in the land that does not own, or at least is interested in a park resort of some kind. In a number of cities, as at Brooklyn, Cleveland, Toronto, and others, this feature has developed to such proportions that it is found advantageous to appoint a separate official, known as the outing or excursion manager, to relieve the general manager of the details of caring for and encouraging pleasure riding. This is a point worthy of consideration. The right man giving his entire time to this one department should have no difficulty in increasing the receipts of the road by a sufficient amount to considerably more than pay the extra expenses, including his own salary.

THE NIAGARA, ST. CATHARINES AND TORONTO ELECTRIC RAILWAY.

The Niagara, St. Catharines & Toronto Railway Company are building an electric railway on the Canadian side of the Niagara river, to work in conjunction with the International Traction Company. The company purchased the franchise of the Niagara Central Railway Company between Niagara Falls and St. Catharines, as well as the Niagara Falls road between that town and Niagara Falls South. It is also proposed to build a line to Hamilton, and possibly to Toronto.

The line between Niagara Falls and St. Catharines is now being operated. Six cars, each fifty feet long, divided into smoking, baggage and passenger compartments, are in operation. These cars are said to contain more glass than any other car ever constructed ; the windows are large, and all the petitions are of glass. It is reported that a speed of seventy miles an hour can be maintained on the line. The stockholders in the company include Messrs. Robt. Jaffray and S. H. Blake, of Toronto, H. H. Herbert, of New York, and Addison B. Colvin, of Glen Falls, N. Y.

TELEGRAPH and TELEPHONE

AN HOUR WITH THE HELLO GIRL.

Number.

Busy.

Hello !

It is a busy hour, and the Central Telephone Office of the city of Toronto is eyes front, with mouth close to the receiver. I see few faces, but scores of bunches of back hair—golden, brown, or black—all artistically arranged ; a strange subdued sound of many voices ; a murmuring as of the wind whispering in the trees, making music with the leaves.

Here is where a great city is doing much of its business.

What tales of love have been whispered through this room ; what of future happiness ! What meetings have been arranged through this room ; what tender messages ; what grim messages ; what hurried calls ! What of natural ; what of supernatural ; what of life, of death —what has it not heard, this murmuring room ? What its secrets !

But its voice is close, as close as the grave.

Tell me some of your hidden mysteries. They would make sudden proof that truth is stranger than fiction.

You refuse !

Perhaps well so. You carry the great unknown of Toronto in these wires in these receivers, in the coils upon coils of wire, in the great jars in the basement below.

And you—Electricity—you, the all-powerful genius, who presides over it all ; you who, yet invisible, work as I watch ; you even now are quietly and mysteriously bringing thousands together in a twinkling. You hear a number called, and laugh at space. Will you tell your secret ?

You, too, refuse !

Before me are the long-distance girls. I bend over ; one is whispering :

" Hello, Chicago ! "

And Chicago whispers back : " Hello, Toronto ! "

Thus a modern miracle is performed.

A husband in Montreal is telling his wife in Bloor street :

" I'll be home on Saturday morning." And she sends him a kiss in a jeff. He receives it in the ear.

Another miracle. And yet the world takes it all as a matter of course.

Little red lights flit above the girls, sometimes glowing like fireflies, then again dying into darkness. The guide explains that when a girl leaves a call unanswered the light burns, but when her connections are made the light dies out.

" Hello ! "

" Number ? "

" Busy ! "

" Yes, it is busy."

" Oh ! you did not ring."

" No, you didn't call me."

" Don't ring so hard. I heard you."

" Drop 5 cents in and push the button."

And so it ran in ceaseless rhythm.

The enquiry office consisted of two wise looking girls, whom the public of Toronto daily deluge with questions, who carry thousands of facts, figures, and numbers in their heads, on their fingers' end ; who are the Solomons, the Daniel Websters, of the room and their world.

We went down to No. 1000, the "trouble department." As I went in a man said :

" Who are you ? "

I started to tell him, but he was talking to a fellow in the West End, who was registering a kick.

Toronto's Central Telephone Office is a great sight in a busy hour.

Charlie Churner, in The Star.

METHOD OF RAISING AND REPAIRING A CABLE.

Some time ago the Great Northwestern Telegraph Company's cable between Kingston and Wolfe Island failed. Recently Mr. A. B. Smith, superintendent of construction, undertook to raise the cable for the purpose of locating the defect. This cable was laid about 35 years ago. It is steel armoured and is about 9,000 feet in length. Owing to its stiffness, the usual method of raising and coiling on the deck of a steamer could not be followed. The plan adoped was to raise the end of the cable at Kingston and fasten it securely on shore. Then the raised portion was thrown across the bow, along the side of the deck, and over the stern of a wrecking tug, the bow of which faced the shore. The tug was then slowly backed up along the route of the cable, the cable being thus gradually raised and carefully examined along its entire length. About midway the cable was cut and the remaining portion tested, but without locating the defect. The portions were spliced together again, and about 1,000 feet from the opposite shore the cable was again cut and tested, but the defect could not be located. It was afterwards discovered, however, in the portion of the cable lying in a trench on the land. It was found that the cable had been flattened and the insulation badly damaged. This has now been repaired, and the cable will be again available for use when required as a part of the system of communication between Canada and New York state.

THE BELL TELEPHONE COMPANY.

Some interesting particulars of the growth of the Bell Telephone Company's system in Canada are contained in the annual report presented at the annual meeting held in Montreal on February 28th, at which the president of the company, Mr. C. F. Sise, presided. The company owns and operates 343 exchanges and 494 agencies. The total number of instruments now earning rental is 38,360. There were added during the year 3,437 subscribers. Mr. Sise, in referring to the pubic's use of the telephone, said that from carefully prepared reports covering all parts of the Dominion it was found that each instrument was used on an average of nine times each day. The average period elapsing between the time the subscriber rang the central until he had the desired communication was eleven seconds.

The long distance lines now owned and operated by the company comprise 21,350 miles of wire on 6,525 miles of poles ; 2,430 miles of wire were added to the system during last year. The receipts for the year were $1,614,262.88 ; expenditures, $1,229,977.56, leaving net revenue $384,285.32, from which $371,304.99 was paid in dividends. The balance, $12,980.33, added to the balance from 1899 of $190,123.38, totals $203,103.71. Of this $32,898.64 was carried to in-

surance reserve, making it $100,000. There was carried to contingent account $46,119.20, and written off plant and patents $50,000, leaving $74,085.87 carried forward to 1901 ; $190,000 of 5 per cent. bonds were sold during the year, the net premium on which was $18,775, and 500 shares of stock were also sold at a net premium of $35,105.80. These premiums, aggregating $53,880, have been carried to contingent account, which with the addition from revenues now amounts to $900,000. During the year the plant and patent account was increased by $858,578.94, and, less $50,000 written off, it now stands at $6,053,015.27. The entire capital stock having now been issued, and funds for construction being required, the shareholders at a special meeting held December 5, 1900, authorized application to parliament for power to increase the capital from $5,000,000 to $10,000,000, and the petition will be presented in due course. At the same meeting the directors were anthorized to issue $2,550,000 of bonds.

METHOD OF PRESERVING POLES.

In setting telegraph and telephone poles the earth should be removed a few inches from the poles and at a depth of two or three inches, and this hole should then be filled with tar oil, so that the pole is tarred just above and below the ground. After this is done the earth should be placed back. In some localities the Bell Telephone and Western Union companies, using large round poles, dig narrow channels from two to three feet deep around the poles and fill the channels with rock salt for surface preservation.

TELEPHONY IN GREAT BRITAIN.

The National Telephone Company, profiting by the experience of the telephone system in America, particularly in San Francisco, intends to extend its operations in Great Britain in a way that will bring the benefits of telephone communication within the reach of a much wider circle than at present. The company is prepared to fit up and maintain telephonic instruments on subscribers' premises on the party-line system. The cost of service is collected at the time by an ingenious arrangement on the penny-in-the-slot system, hence there is no account to meet monthly or quarterly, as the case may be, and all liability is confined to the following rates : Two dollars and 50 cents a month for each subscriber on a two-party line, $2 on a four-party line, and $1.25 on an eight-party arrangement. Under this last head the total cost works out at $15 per annum.

Owing to the many complaints made by subscribers of the delays in getting connection with places in the country, the National Telephone Company has communicated with the postoffice in hope of remedy. The response, however, is to the effect that a minimum of 20 minutes must always elapse before any reply can be made as to when a call for a telephone district outside the metropolis will be answered. It is believed that an insufficiency of trunk lines and a lack of employees are responsible for this new and vexatious regulation, which is certainly not a hopeful augury for the coming postoffice telephone system.

The shareholders of the Sackville Electric Light Company, of Sackville, N. B., have decided to enlarge the plant. A brick building will be erected, and a new boiler and engine installed.

PERSONAL.

Mr. Walter White, son of Hon. A. J. White, of Halifax, N. S., has been appointed manager of the Sydney Electric Light Company, of Sydney, C. B.

Richard Shopland, late in the employ of the London Electric Company, has accepted the position of chief engineer of the Sandwich, Windsor & Amherstburg Street Railway.

Mr. James Milne, who has been in Chicago for some time in connection with the management of the Jones Underfeed Stoker Company, has returned to Toronto and will assume the management of the Canadian business of that company.

Mr. Thos. Proctor, late city electrician at Fort William, Ont., was a recent visitor to the office of THE ELECTRICAL NEWS. After an experience of twelve months as a civic employee, Mr. Proctor decided to give somebody else a chance, and has now gone to fill a position in Vancouver, B. C.

Mr. F. L. Wanklyn, manager of the Montreal Street Railway, has returned from Jamaica, where, as chairman of the board of construction of the West India Electric Company, he made an inspection of the company's property. Mr. Wanklyn states that twenty three miles of the road are in operation, and he found the system in excellent condition.

Mr. W. T. Bonner, who for some years has been general manager in Canada for Babcock & Wilcox Company, of London, England, has severed his connection with that company, to engage in business for himself. During Mr. Bonner's regime the business of Babcock & Wilcox in Canada grew from a very small beginning to large proportions. We wish him continued success in his new field.

Mr. Harold Fraser, C.E., son of the late Hon. C.F. Fraser, has been selected to manage the electric light and gas plants recently taken over by the corporation of Brockville, Ont. Mr. Fraser graduated from McGill College as an electrical and civil engineer, and was entered for a post graduate course when he enlisted in the first contingent for South Africa. He spent a short time in a large manufactory of electrical apparatus in Plattsburg.

Mr. O. P. St. John, inspector of the Boiler Inspection & Insurance Co., of Toronto, recently met with a serious accident at the power house of the London Electric Company, London, Ont. Mr. St. John had inspected one of the new water tube boilers, and was getting out of the boiler when he accidentally fell to the floor, a distance of about twelve feet, striking his head on the rough edge of the brick work, inflicting a scalp wound which required twenty stitches, and breaking 3 ribs. For a time his condition was considered critical, but we are pleased to learn that he is now on the road to recovery.

MOONLIGHT SCHEDULE FOR APRIL.

Day of Month.	Light.	Extinguish.	No. of Hours
	H.M.	H.M.	H.M.
1....	3.00	5.00	2.00
2....	No Light.	No Light.	
3....	"	"	
4....	"	"	
5....	P.M. 7.00	P.M. 9.45	2.45
6....	" 7.00	" 10.40	3.40
7....	" 7.00	" 11.30	4.30
8....	7.00	0.30	5.30
9....	" 7.00	1.15	6.15
10....	" 7.00	" 2.00	7.00
11....	" 7.00	A.M. 2.45	7.45
12....	" 7.00	3.30	8.30
13....	7.00	" 4.00	9.00
14....	" 7.10	" 4.30	9.20
15....	" 7.10	" 4.30	9.20
16....	" 7.10	" 4.30	9.20
17....	" 7.10	" 4.30	9.20
18....	" 7.10	" 4.30	9.20
19....	" 7.10	" 4.30	9.20
20....	" 7.10	" 4.30	9.20
21....	" 7.20	" 4.30	9.10
22....	" 7.20	" 4.30	9.10
23....	" 10.30	" 4.30	6.00
24....	" 11.15	" 4.30	5.15
25....	11.50	4.30	4.40
27....	0.30	4.30	4.00
28....	" 1.00	" 4.30	3.30
29....	A.M. 1.30	4.15	2.45
30....	" 2.00	4.15	2.15
		Total	169.00

TRADE NOTES.

A very attractive calendar has been issued by the Syracuse Smelting Works, of Montreal. In the centre are a couple of lady cyclists mounted on a tandem machine coming down a mountain side on a bar of the company's babbit metal. Below are the words, "Let 'em slide—it is frictionless."

Mr. Robert Watt, who has been the travelling representative in northern Ontario for the Waterous Engine Works Company, of Brantford, has been appointed the company's Toronto agent.

The Crows Nest Pass Coal Company have ordered from the Robb Engineering Company, of Amherst, N. S., a 250 horse-power engine for their mine at Fernie, B. C. This is the second engine of this size supplied them within a few months.

Nearly fifty representatives of the International Correspondence Schools visited Scranton, Pa., early in February and were entertained by the schools. Among them were men from Portland, Me., to Winnipeg, Manitoba. The schools have 300,000 students residing in all parts of the world, and as instruction is carried on by mail a large staff of instructors and correspondents is required at the home office. A day was spent by the visitors inspecting the school buildings, which are among the largest and finest in Scranton. Several meetings were held and addresses made by Mr. T. J. Foster, president of the schools, and by a number of the principals. In the evening a banquet was given at the Hotel Jermyn. Almost every visitor brought a letter from a student with whom he was personally acquainted, and the reading of these letters telling of better positions, larger salaries and other benefits secured by students as a result of their studies, was a glowing tribute to the successful methods of the schools.

TECHNICAL EDUCATION BY MAIL.

Ambitious men who desire to obtain better positions and higher wages should carefully investigate the free scholarship offer made in another column by the American School of Correspondence, Boston, Mass. This well-known school, situatedat a recognized industrial and educational center, has among its instructors men who are regular teachers in several of the great technical schools of Boston, and has unusual advantages for teaching the theory of trades and engineering professions. Their free scholarship for engineering and mechanical drawing is a feature which should attract attention. Without leaving home or losing time from his regular work, the student pursues a thorough course of study under the direction of able instructors. Papers guiding him in his work are prepared and delivered to him. These papers, free from the technicality that usually encumbers text-books, are clear and concise in language and much superior to the ordinary text-books on the subjects on which they treat. Besides this, special information concerning any difficulties which may arise in their course is furnished to the students. Altogether, the course of study outlined is exceedingly attractive, and long experience has shown that no other method so fully meets the requirements for men who have but little time for study as that of teaching by mail. Notice the school's advertisement on another page.

The fifty-fourth annual meeting of the Montreal Telegraph Company was held in Montreal recently. A very satisfactory statement was presented. Mr. Andrew Allen was elected president, and Mr. Hugh A. Allen vice-president.

AN OMISSION.

Through an oversight, the name of the writer of the letter in our February number under the caption of "One of the First Automobiles," was omitted. The name of Charles Baillairge, the well known architect and civil engineer, of Quebec, should have been attached thereto. The full measure of credit is due the inventor of what was at that time considered a most novel and interesting piece of mechanism.

SPARKS.

William Sleeth, engineer at the Rossin House, Toronto, is nursing a broken arm, the result of a fall at the corner of King and Simcoe streets.

The Laval Electric & Power Company has been incorporated, with a capital of $100,000. W. H. Garth, Eugene S. Manny, and others of Montreal, are the applicants.

Alex. McFarlane, a locomotive engineer, son of James McFarlane, engineer of the Hamilton waterworks pumping house, was accidentally killed in the Chicago and Erie railway yards at Chicago by being struck by an engine.

The Citizens Light & Power Company, of Montreal, held their annual meeting recently, at which a dividend of 5 per cent. per annum was declared. Officers were elected as follows: President W. McLea Walbank; vice-president, J. H. Burland; secretary, Robert Whyte.

The city council of Halifax, N. S., have decided to establish a municipal electric plant, to supply municipal and commercial lighting, and thus to enter into active competition with the Halifax Electric Tramway Company. The estimated cost of a suitable plant is $100,000. A site has been selected for the power house.

Mr. A. H. Bruce, C. E., is making surveys of the Chats water power at Fitzroy Harbor, Ont. Among the streams which add materially to the Chats power are the Carp river, the Bonnechere river, and three or four othes streams running east into the harbor. Mr. Louis Simpson, late of Valleyfield, Que., is one of the parties interested in this proposed development.

A new rotary snow plow was put in operation this winter on the Montreal Street Railway system. It is built like an ordinary freight car, but is not more than twenty feet in length. A steel hood is attached to the front of the car, and in this revolve two electric fans which throw the snow to either side of the track or to one side only, at the pleasure of the operator.

We are told that Prof. V. F. Emerson, of Ottawa, has invented an incandescent oil lamp for which wonderful results are claimed, such as the operation of a lamp of 600 candle power at a cost of one-tenth of a cent an hour. The light is generated entirely from coal oil, and it is claimed that the expense of operating the new light will not exceed the cost of an ordinary carbon in an arc electric lamp.

Judge Brown, of the United States Circuit Court, has decided against the American Bell Telephone Company in the famous Berliner patent case. The suits were the Bell Tejephone Company against the National Telephone Manufacturing Company and others, and same against the Century Telephone Company, brought to restrain respondents from selling, using or making telephones or teleponic apparatus with the microphone attachment, and to account to the Bell Telephone Company for past use, manufacture and sales, upon the ground of an infringement of patent.

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SPARKS.

Mr. J. W. Marr is again on the road for The Steam Specialty Company, of Toronto.

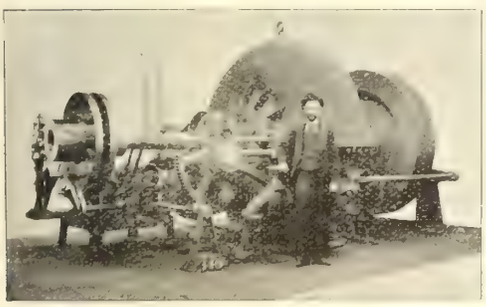
Managers of electric lighting companies should be on the lookout for a couple of young men who recently threatened to make trouble between the manager of the Toronto Electric Co. and his customers because he refused to purchase from them, at the price of $900, a meter tester worth about $500. The system of inspection established and operated by the Dominion Government is the proper court of appeal for both electric lighting companies and their customers.

The Brandon Electric Light Company, of Brandon, Man., are building a new transmission plant, which they expect to have in operation about July next. The power house will be located on the Little Saskatchewan river about nine miles from Brandon, where they are constructing a heavy timber and stone dam. This dam will give from twelve to fifteen feet head, and will create a reservoir of considerable capacity. The water wheel plant, consisting of two 54 inch vertical cylinder gate "New American" wheels, is being built by the William Kennedy & Sons Company, of Owen Sound. The electrical plant at the outset will consist of a 300 k. w. revolving field three-phase generator at the water power station, and a 250 k. w. synchronous motor to operate the plant now being run by steam, and will be supplied by the Canadian General Electric Company. There seems to be a promising future for this company, of which Mr. G. A. Patterson is manager director.

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SPARKS.

It is said that United States capitalists are negotiating for the purchase of the Brantford street railway.

Mr. Alex. Dobson, of Beaverton, Ont., has made application for permission to build an electric railway from his peat works to the G. T. R. station at Beaverton.

A by-law has been carried by the ratepayers of Paris, Ont., to purchase the electric light plant at present owned and operated by Mr. W. H. Meldrum. The price to be paid is $15,000.

An arbitration is about to be commenced in the city of Kingston, Ont., to ascertain the value of the electric plant of the Kingston Light, Heat & Power Company, it being the intention of the city council to take over the plant and operate it under municipal control.

The street lighting difficulty at Aurora, Ont., has reached a final settlement by the council arranging for a continuance of the electric light for a period of five years. The Kitson Carbon Company tendered, but the sentiment of the ratepayers was strongly in favor oi electric light.

The initial use of electricity at Shawinigan Falls, Que., was made early in February. An electrical installation for 10,000 horse power is being set up. The hydraulic development completed is 75,000 horse power, which is claimed to be 25,000 more than has yet been developed at Niagara Falls.

Mr. J. P. Kane, chief instructor of the Metropolitan Street Railway Company, New York, became a student of the International Correspondence Schools, Scranton, Pa., over two years ago. He says that the instruction has been invaluable to him in his work, and that many employees of the same company who have enrolled in the schools have been greatly benefitted by their studies.

Negotiations are said to be under way for the consolidation of the electric power and lighting plants at St. Catharines, Ont. Recently Mr. John Knox, who claims to be the representative of the Lincoln Light and Power Company, a newly organized concern, purchased William Cook's electric power and lighting plant, and it has been hinted that the control of the St. Catharines Electric Light Company is hoped for.

The Montreal Street Railway Company expect to have ready by the end of May twenty-five new double truck open cars, with thirteen seats, giving seating capacity for sixty-five people. Besides the 5000 horse power from Chambly, the Street Railway Company have placed orders for two new steam units of 1,500 horse power each. One of these is being made in Montreal by the Laurie Engine Company, and the other in Philadelphia.

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In the large and well equipped factories where the manufacture of electrical apparatus is carried out under the piece work system, they find that repair work or apparatus sent in to be repaired or rewound interferes with this system, and in many cases they would prefer not to do this kind of work, as it is almost impossible to do it with dispatch and at a reasonable price. Knowing the above to be a fact,

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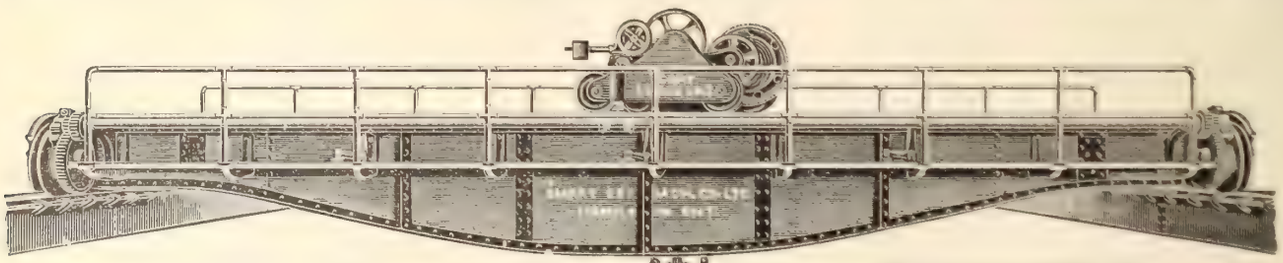
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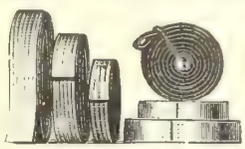


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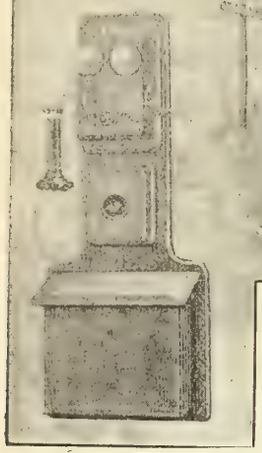
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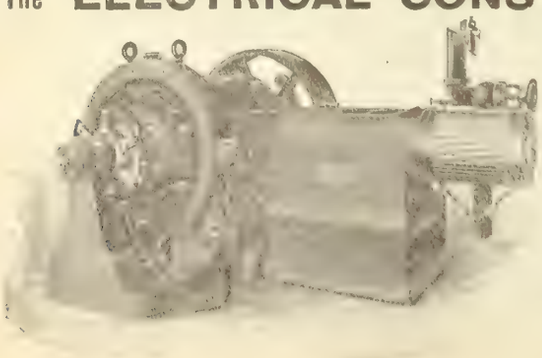
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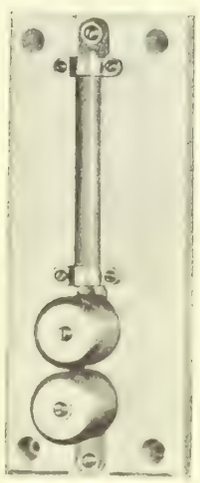
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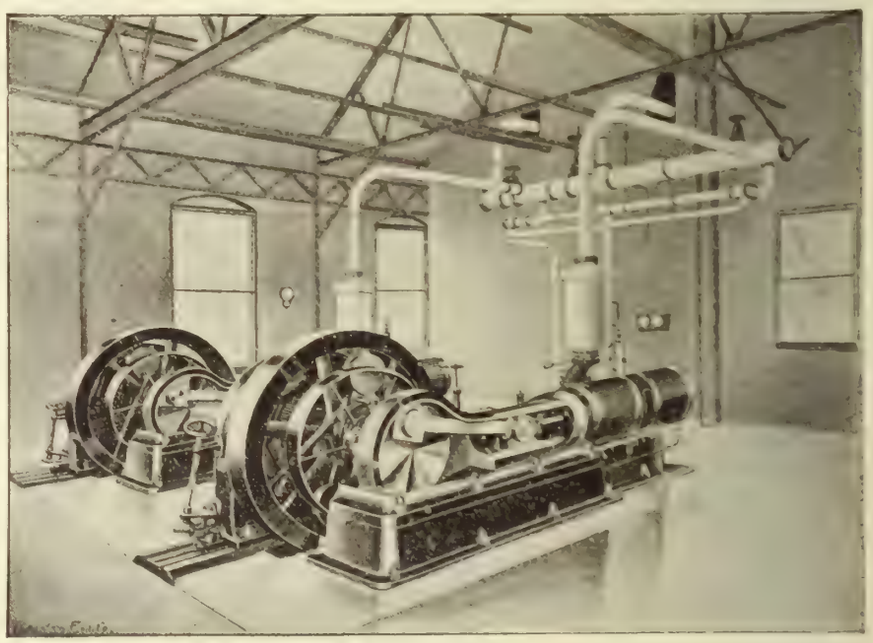
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SPARKS.

The electric plant of James A. Spence, of Colborne, Ont., has been sold to P. Coyne.

The Goldie & McCulloch Company, of Galt, Ont., are building an addition to their works.

Another by-law may be submitted to the ratepayers of Parry Sound, Ont., to provide funds for the acquisition of the electric light plant.

Mr. John H. Jewell, of Toronto, has organized the Port Dover Improvement Company, to establish a summer resort at Port Dover, Ont., and to build an electric railway from Brantford and Waterford to that place.

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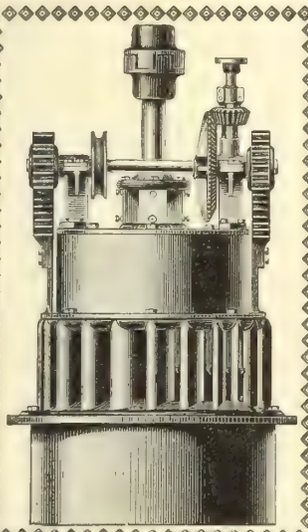
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PERSONAL.

It is learned that Mr. C. A. Chant, M.A., lecturer in physics at Toronto University, who is at present taking a post graduate course at Harvard, has been given a scholarship and will remain there until the fall. He is devoting his attention to the mastery of Marconi's wireless telegraphy and Pubin's oceanic telegraphy.

Mr. Fred Thomson, of Montreal, has been appointed to represent the Kingston Light, Heat and Power Company in their arbitration proceedings which are about to be commenced to determine the price to be paid by the municipality for the company's plant. Mr. J. M. Campbell will be the city's arbitrator. Both gentlemen are well qualified to watch their client's interests.

The late Mr. H. C. Symmes, who died at his residence at Niagara Falls South last month, had been for some years associated with railway work, being in his earlier days on the engineering staff of the Great Western Railway. He was a member of the firm of Dawson & Symmes, owners of the St. Catharines Street Railway, and was also identified with the Ontario Power Company.

Mr. Archie C. McDonald, E.E., who was formerly on the Royal Electric Company's staff, has recently been appointed as engineer and local manager for British Columbia for the Fairbanks Company, of Montreal. Mr. McDonald's many friends throughout the country will be pleased to learn of this appointment, and will join with us in wishing him the greatest possible sccccss in his new field of endeavor.

Mr. Edward Hanson, president of the Havana Electric Railway Company, has recently returned to Montreal from Cuba, and states that satisfactory progress is being made in building the electric road at Havana in which Canadian and American capitalists are interested. About half the line is now in operation. In Havana, Mr. Hanson states, no one walks, as is evidenced by the fact that there are 1,400 licensed cabs and 200 busses employed there.

Mr. Sangster, of the Sherbrooke Electric Light Company, is said to be considering the advisability of enlarging the capacity of the company's lighting station, and also of adopting extra precaution for the protection of the plant against destruction by fire.

SPARKS.

Improvements are about to be made to the electric light plant at Huntsville, Ont., owned by the corporation.

Hon. Mr. Latchford, M.P.P., is said to be preparing a bill to compel street railway companies to provide a life saving fender for their cars.

It is said that steps are under way looking to the construction of a telephone line connecting Port Carling, Bala and Bracebridge, in the Muskoka district.

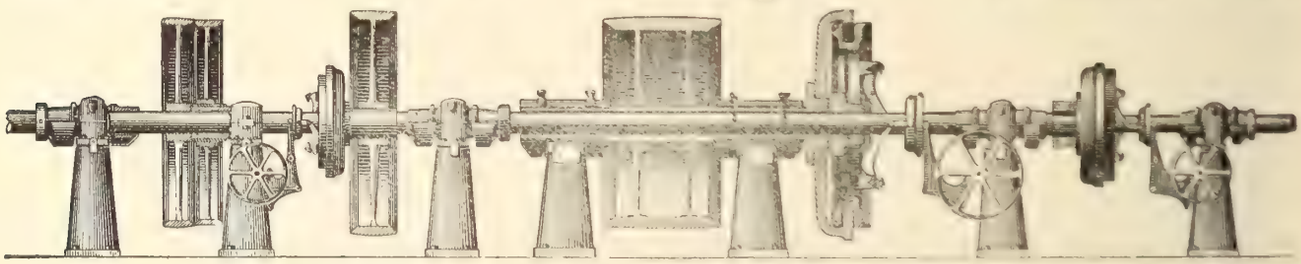
The Ottawa Electric Railway Company have commenced work to cast and weld the rail joints on their various lines. The work is being carried out at night and does not interfere with the regular service. From 75 to 100 joints can be welded each night, and the average cost is about five dollars a joint. By this system the use of fish plates and bolts is entirely abolished.

The city council of Vancouver, B.C., have granted an eighteen year franchise to the Stave Lake Power Company to supply light and power within the city. The company must deposit $25,000 as a guarantee of good faith, and agrees to supply the city with power at a maximum rate to carry on its own lighting system in the event of the city buying out the present company.

The report of the Commissioners of the Queen Victoria Niagara Falls Park for the year 1900 was recently placed before the Ontario Legislature. The Commissioners state that no active steps have been taken by the Canadain Niagara Power Company to carry out the work laid down in their agreement with the Government. The receipts of the year included: Rentals from Canadian Power Company, $15,000; Ontario Power Company, two years, $30,000; Niagara Falls Park & River Railway Company, $10,000.

On March 19th the new works of the Electrical Construction Co., of London, Limited, were formally opened by a banquet tendered by the company to the employees. The building, which is situated on Dundas street, was elaborately decorated, and the entire building illuminated by their own electric plant. After a sumptuous dinner an interesting toast list followed, the manager, Mr. E. I. Sifton, responding to "Manufacturing Interests," and the superintendent, Mr. T. A. Cahill, to "The Employees of the Electrical Construction Company."

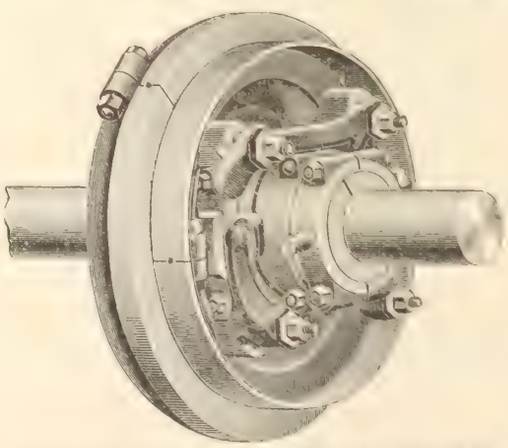
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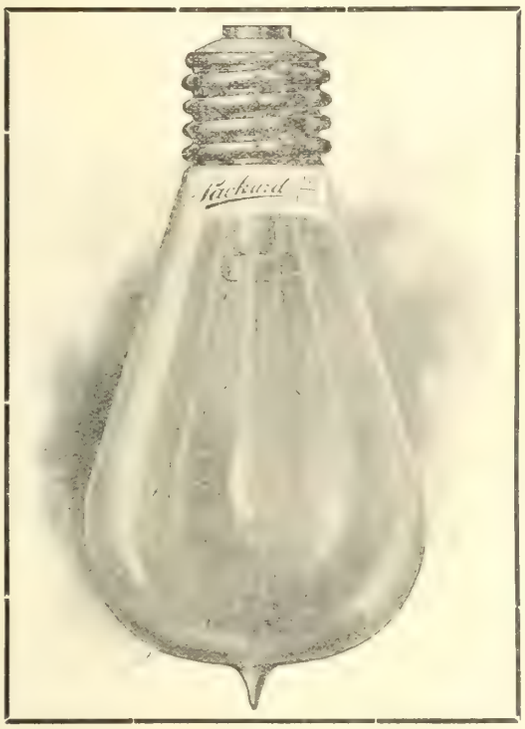
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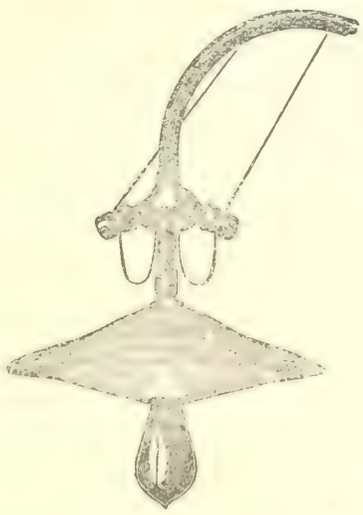
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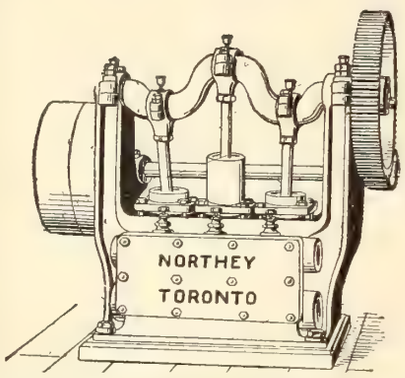
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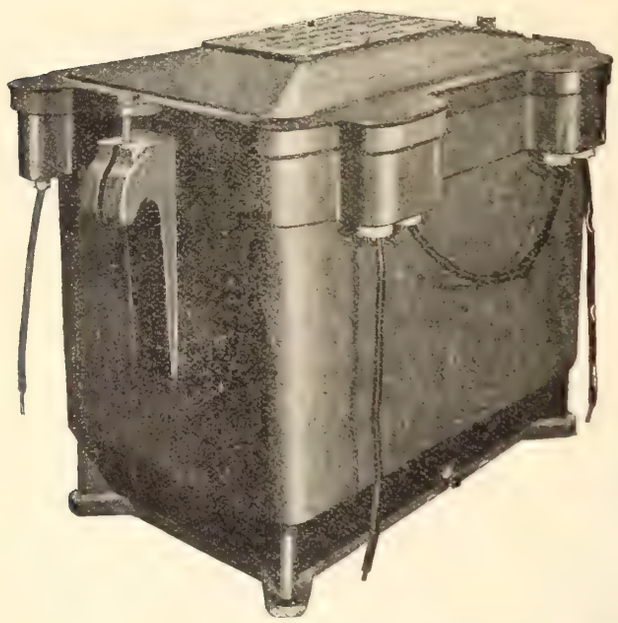


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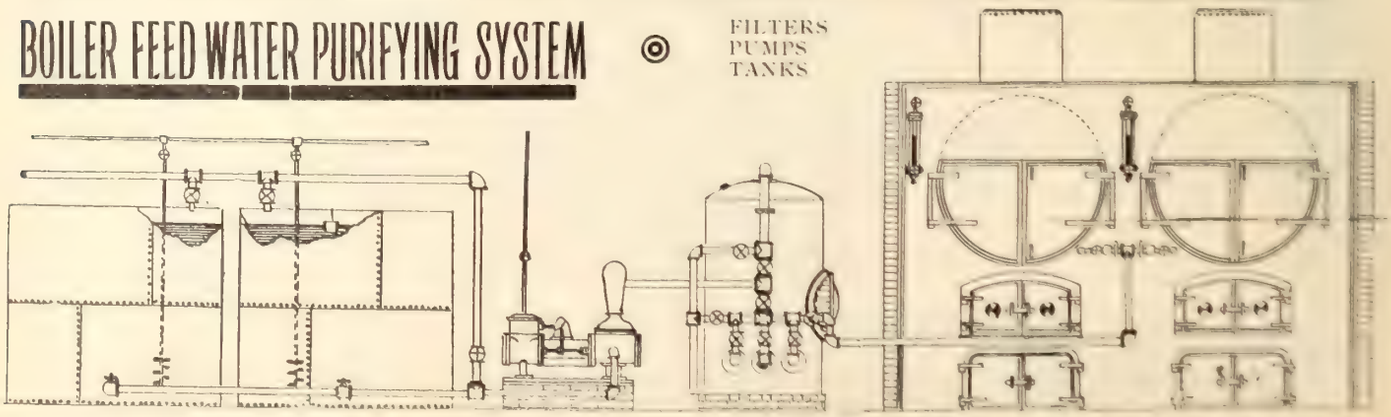
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CANADIAN
ELECTRICAL NEWS
AND
ENGINEERING JOURNAL.

VOL. XI. APRIL, 1901 No. 4.

THE SNOQUALMIE FALLS TRANSMISSION PLANT.

Of the several transmission plants in operation on the Pacific coast, one of the most important and interesting is that of the Snoqualmie Falls Power Company, located in the state of Washington—important on account of its magnitude, and interesting on account of its several novel features and constructive details, the most notable being the subterranean generating station and the use of aluminum wire for the transmission lines.

The height of the falls is 267 feet, exceeding the Niagara Falls by 100 feet. About one-quarter of a mile above the falls a series of readings were taken, and the average velocity obtained was about ten feet per second. The rock at the falls is basaltic, with no regular cleavage, is hard and non-absorbant, and apparently is divided into great ledges by seams. These conditions led to the adoption of the scheme of placing the entire generating plant in an underground chamber, as shown by Fig. 1, thus removing the necessity of

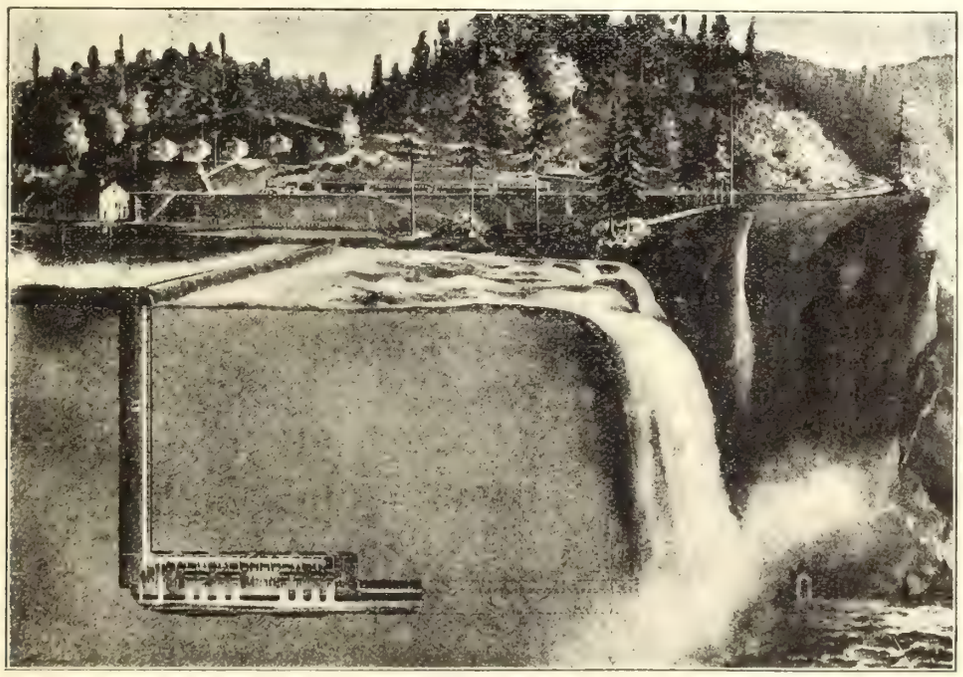


FIG. 1.—SUBTERRANEAN GENERATING STATION, TAIL RACE TUNNEL AND FALLS.

The great falls of the Snoqualmie river are situated twenty-five miles easterly from Seattle, in the foothills of the Cascade range. From a heavily timbered watershed of about 600 square miles in area on the westerly slope of the Cascade mountains, and reaching an altitude of over 8,000 feet, flow the three principal tributaries of Snoqualmie river, which unite about three miles above the falls, forming the river proper. These rivers have their origin in the region of perpetual snow and ice, and are fed by tributary streams which also originate in lofty regions and are fed by means of the snow and ice. The maximum flow of the Snoqualmie river is 160,000 cubic foot seconds, and the minimum flow 10,000. The river does not freeze, so that floating and anchor ice are unknown. Although the water reaches as low a stage at the falls as 30,000 horse power, a uniform flow of 100,000 horse-power is obtainable throughout the year by the utilization of natural storage basins. The average rainfall at the falls is about 90 inches per annum.

having a long flue or pipe line, as is usually required.

HYDRAULIC DEVELOPMENT.

The water is taken direct from the river into the intake, a massive concrete and steel construction, about 60 feet along the river. It is built upon the solid rock formation of the river bed, with walls six feet deep and twenty-five feet high. To keep out floating logs and trees the front of the intake is protected by a timber grating supported by a steel girder frame built into the concrete. The forebay thus formed is divided into two headbays separated by a concrete wall six feet thick, both equipped with a massive timber bulkhead and head gate, having an opening 8x12 feet, through which the water flows to the penstocks. The active headbay is further protected by a screen made of flat steel bars on edge, and the timber grating is protected from floating logs by a floating fender in the form of a rudder boom 300 feet long, which is moored above the intake

and extends past it. For a considerable distance up and down the stream the river banks are protected by massive timber bulkheads constructed of sawed cedar 12x12 inches laid horizontally.

For the purpose of raising the low-water elevation of the river at the top of the penstock to a depth of a minimum of eight feet, a dam was constructed across the river about 200 feet below the intake and 200 feet above the crest of the falls. At each end of the dam is an abutment pier eight feet square and five feet in height above the crest of the dam. This elevation is also that of the lower bulkhead, which below the dam is continued in the form of a heavy concrete retaining wall, with an average batter of one-half to one. Thus is formed a spillway over which the water freely flows whenever it exceeds a depth of five feet over the crest of the dam, and allows for the discharge of flood waters without unduly raising the surface of the river above the dam.

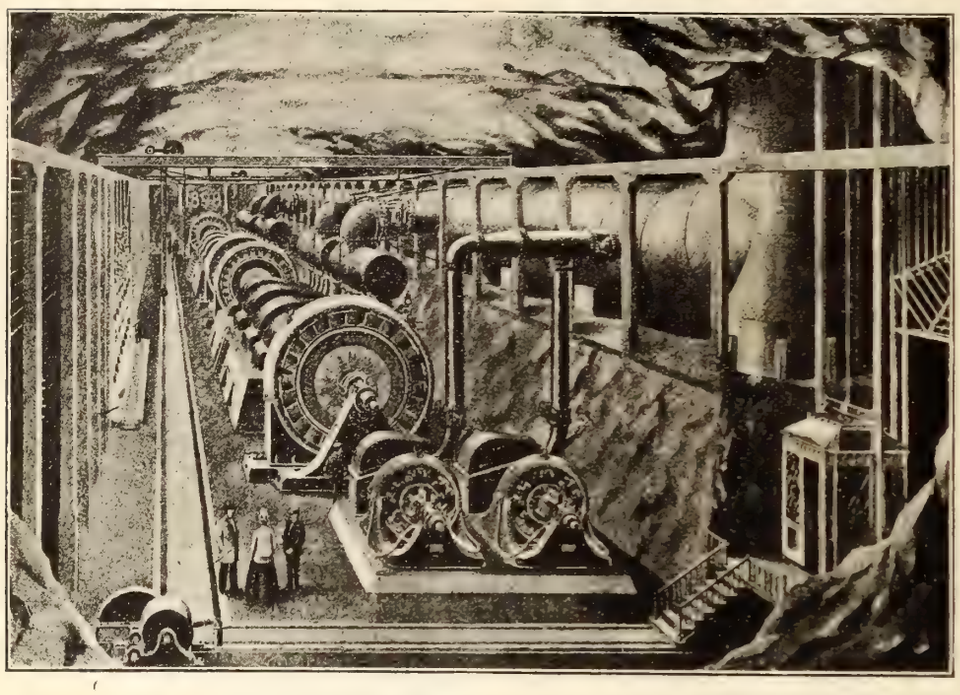


Fig. 2.—Underground Machinery Chamber.

THE SUBTERRANEAN POWER HOUSE.

About 300 feet above the falls a shaft 10 x 27 feet was sunk in the bed of the river on the south side, descending 270 feet to the level of the river below the falls. While this shaft was being excavated, a tunnel 12 feet wide and 24 feet high, with a fall of 2 feet in its entire length, was drifted in from the face of the ledge below the falls to an intersection with the bottom of the shaft, a distance of 650 feet. Beginning at the foot of the shaft and extending over and along the tunnel, a chamber 200 feet in length, 40 feet wide and 30 feet high, with the floor at the elevation of high water below the falls, was excavated out of the solid rock. This chamber forms the power house in which the water wheels and electric generators have been installed. The tunnel extends under the floor of the chamber, forming a tail-race, with a concrete roof five feet thick. About 700 incandescent lamps are used to light the shaft, chamber, and tunnel.

The top of the shaft is divided into three compartments; the two end compartments are for the penstocks, while the centre one forms a shaft 8x10 feet for the hydraulic elevator and the main cables forming the outgoing conductors, and also for raising and lowering machinery, etc. The penstock and receiver is a steel pipe 7½ feet in diameter and 250 feet in length. Reaching the chamber, it connects with a horizontal cylindrical receiver which rests on a rock bench in the north side of the chamber, 12 feet above the floor. The penstock and receiver weigh 225 tons, and the weight of the water column in the penstock is 340 tons. The receiver is 10 feet in diameter for half its length and eight feet for the remainder.

THE MAIN HYDRAULIC PLANT.

The main generating units are said to be the largest and most powerful tangential wheels thus far attempted under similar head. They consist of four units, each developing 2,500 horse-power and being direct connected to its generator. The receiver of each unit has four supply openings, which are controlled by individual double-screw gate valves of 48 inches inside diameter and weighing 23,000 pounds each. This receiver is hori-

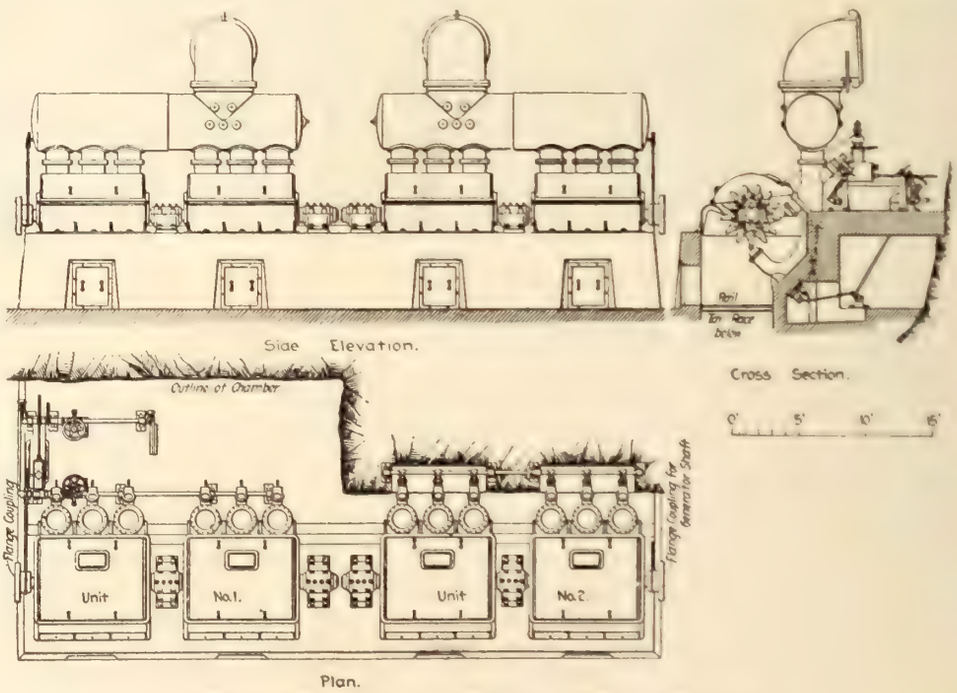


Fig. 3.—Elevation and Section of Water Motors.

zontal, and the openings are on its side and open towards the cavity. Bolted direct to the gate valve is an elbow casting, 48 inches insid ediameter, that directs the water directly downward into the distributing receiver.

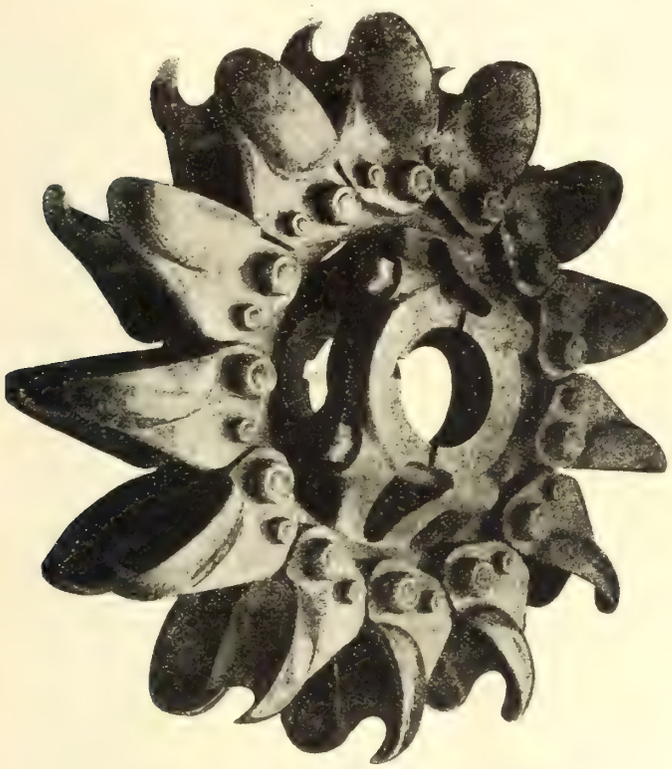


Fig. 4.—One of the Doble Water Wheels.

The elbows are bolted directly to the flanged opening of the distributing receiver. The water enters the distributing receiver flowing in a downward direction, and without changing this general direction is discharged from the six openings along the bottom into the six multiple nozzles that direct and regulate the water that is applied to the wheels. Figure 3 shows a view of the exciter wheel and regulating nozzle.

The distributing receiver is directly over and supported by the six regulating nozzles standing upright upon the foundation, and the water is discharged from the distributing receiver into the nozzle without any change in direction. The nozzles stand upright on the foundation, and the extreme or lower end is curved so as to direct the water upward against the wheel, the end of the nozzle terminating in a tip. Each nozzle has two tips, each tip discharging a jet of 3⅞ inches in diameter. The first tip is at the upper end of the nozzle and discharges the water in a downward direction against the wheel.

To handle the volume of water necessary to develop the power in each unit under the head of 225 feet, requires twelve jets, dischaging against six wheels, there being six wheels in each unit. For convenience of bearing and shaft design, these wheels were divided into two groups of three wheels each, each group being in a separate housing with a bearing between. The regulating tips used on the nozzle give an absolute control over the quantity of water applied to the wheels ; therefore over the power output of the unit. As the nozzles are controlled by the governor, they give a perfect speed regulation with variable load at a high efficiency. The regulating nozzles are operated from two long rocker-shafts by means of cranks and connections. The six wheels have split hubs and solid ribs ; they are 45 inches in diameter and are provided with buckets of the ellipsoidal type. The 13 buckets used are attached to the wheel rim by fitted bolts, so that the buckets can be replaced when they become worn from scour or otherwise deranged. This is claimed to be an advantage over wheels of the turbine type where the buckets are part of the wheel casting. The six wheels are keyed on the shaft in two groups of three wheels each. The shaft is supported in two bearings of the ring-oiling removable shell type. One bearing is at the extreme end of the shaft, and the second in the middle of the shaft length and between the two wheel housings. The generator bearing carries the other end of the shaft through the shaft coupling.

Each wheel unit weighs about 100,000 pounds. The wheels operate at 300 revolutions per minute. The foundations are built of concrete, and are cemented solidly into the floor and one side wall of the cavity. The tail-race for the discharge water from the wheels is excavated beneath the foundation, so that the waste water drops from the wheels into the tail-race and flows out to the river below the falls. The foundation for each unit is divided into two compartments corresponding to the two wheel housings.

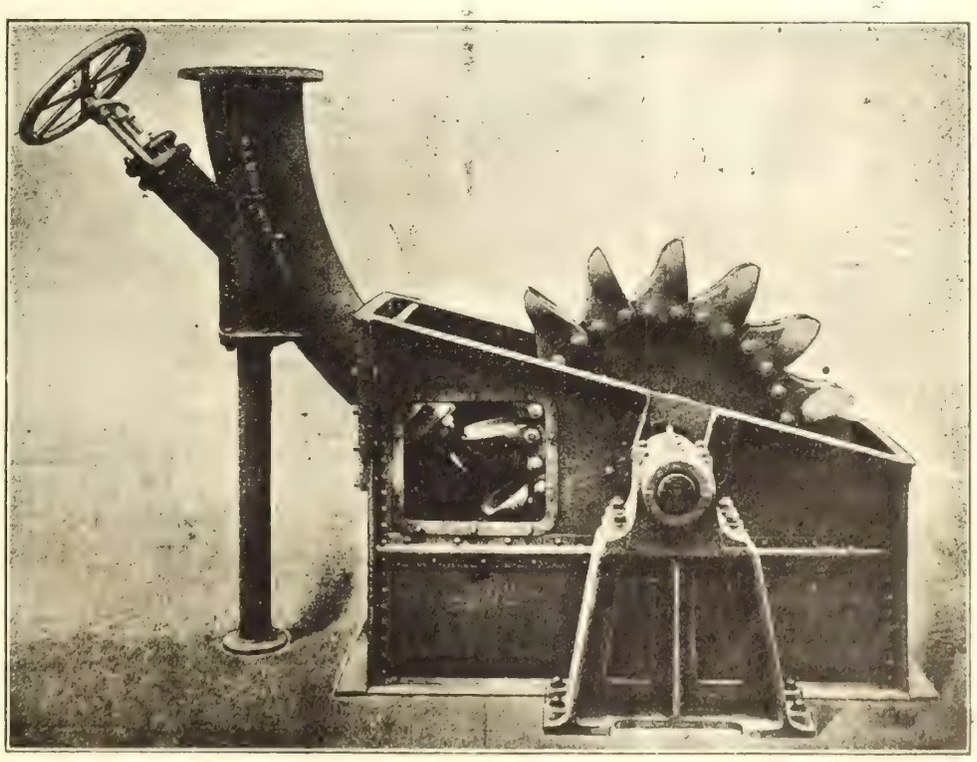


Fig. 5.—Exciter Wheel and Regulating Nozzle—Housing Open.

The exciters are of 75 kilowatt capacity and are direct connected to the tangential ellipsoidal water wheels of 45 inches diameter. The wheels are mounted in steel usihongs and are supplied with water through a regulat-

ing nozzle of three inches jet diameter. The water is carried to each exciter through a vertical pipe 12 inches in diameter, so that the nozzles are in an upright position. To permit of cleaning the armature of the generators while working, compressed air is furnished by a vertical type air-compresser, with an 8 x 10 inch cylinder.

Although the plant has an output of 10,000 electrical horse power, the main receiver and connections, water wheels, generators, travelling cranes, exciters, elevator gear, switchboard, and all auxiliary apparatus are contained in a cavity of 40 feet wide, 30 feet high and 200 feet long, while the entire station output is regularly operated and cared for by two men on a shift, one an electrician on the switchboard and in charge of the station, and the other an oiler whose principal work is one of inspection and keeping the entire station in good order.

ELECTRICAL EQUIPMENT.

The generators in the power house, of which there are four, are of the Westinghouse revolving armature, 1,500 k. w., two-phase type, 7,200 r. p. m., 1,000 volts. Each generator weighs about 100,000 pounds and stands 14 feet high. The normal full load current is 1,000 amperes per conductor. The armature winding is a closed circuit, and consists of 266 bars with one bar per slot. The armatures are 96 inches in diameter, weigh approximately 24,000 pounds each, and operate at 300 r.p.m. Massive collector rings of the ventilated type deliver current to the external circuits. Three brushes bear on each ring, and to ensure equal division of current between them in case of unequal contact resistance, separate cable leads of considerable length connect the brushes and the outside circuit, in order that the fixed resistance with each brush may be large compared with the possible variable resistance. In these armatures about 4,500,000 foot-pounds of energy are stored at 300 r.p.m., and from the construction of the water motors the moving water column also contributes to the stored energy, since it operates directly upon the revolving parts of the water motors.

There are two separate 125 volt, 75 k.w. exciters, each being more than sufficient in capacity to supply field current to all four of the generators. These exciters are each separately driven by a 100 horse power wheel, mounted in steel housings.

The switch-board is of white marble, with mountings of brass and bronze. It has eighteen panels, four for generators, two for the exciters, and twelve for the feeders, also two sets of busbars so that different classes of load may be carried separately. Each generator panel has circuit breakers on two of the three phases, synchronizing and pilot lamps, field ammeter, a main ammeter on each of the three circuits, indicating wattmeters of the Niagara type, a field rheostat, double-throw three-pole switches, and voltmeter and ground detector plugs. The exciter panels carry ammeters, circuit breakers, ground detectors, voltmeter plugs and rheostats, and the feeder panels have circuit breakers, ammeters and a double-pole double-throw switch. The switch-board also carries three alternating current voltmeters on swinging brackets, by means of which the voltage in any phase of any generator may be read.

From the feeder panels of the switch-board 24 aluminum cables are provided for conducting the 1,000 volt current up the elevator shaft to the transformer house. There are 12 raising transformers of the standard Westinghouse self-cooling, oil insulated type, 550 k. w. capacity each. The primary winding is for 1,000 volts, and the secondary winding for either 15,000 or 30,000 volts. Each transformer weighs 10,850 pounds, and is supplied with two high tension fuse circuit breakers by which it may be disconnected either by hand or automatically in case of excessive current load. The three phase current is delivered to the line by the Scott system.

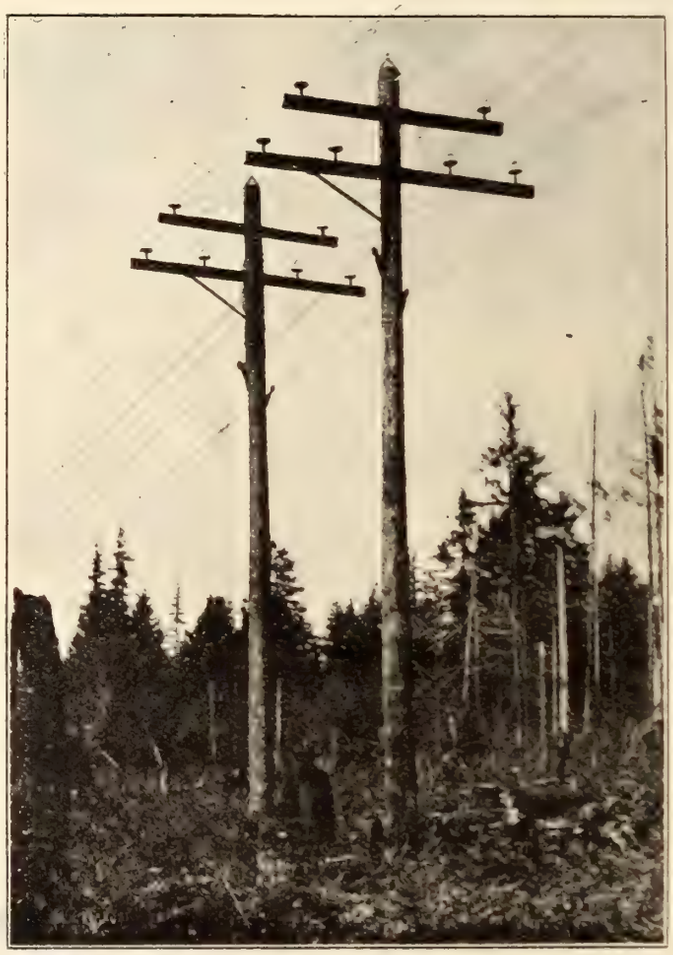


FIG. 6. METHOD OF LINE CONSTRUCTION.

THE POLE LINE.

The transmission wires of the pole line are of aluminum. The conductivity of aluminum is about 60 per cent. of that of copper, so that the aluminum wire, in order to have a capacity equal to copper, must have a cross section about 60 per cent. greater, but with this increased size the weight is claimed to be slightly less than 50 per cent. that of copper. The tie wires are of soft No. 8 B. & S. gauge aluminum wire. The length of the line to Seattle is 31 miles, diameter 26 inches, and the total weight of wire 67,000 pounds. The line to Tacoma is 44 miles in length, 23 inches in diameter, total weight 72,000 pounds. There are two three-phase three-wire circuits to Seattle and Tacoma respectively.

The poles are of cedar, 9x13 inches x36 feet and upwards to 154 feet. The lines are carried on triple petticoat Imperial porcelain insulators 4½ inches high and 6½ inches in diameter, weighing four pounds each, furnished by C. S. Knowles, of Boston. The pins are of locust, boiled in paraffin oil. Two circuits are run on each pole line, one on each side, with a triangular spacing of 30 inches between the wires. The length of span on the Seattle line is 90 to 150 feet, the average being 110 feet. On the Tacoma line the average span

is 150 feet. A winter sag of about 15in. is allowed, this being considerably greater than is common practice with copper wires. The ohmic resistance on the Seattle line is from 84.5 to 88 ohms, and on the Tacoma line 76 ohms.

THE SUB-STATIONS.

The first sub-station is at Isaquah, 10 miles from the power-house, from which current is distributed for lighting the town and furnishing power to the coal mines. It contains a step-down transformer of 50 k.w. capacity and from 30,000 to 2,000 volts with variable secondaries, the current therefor being taken from one phase of one of the Tacoma circuits. The next sub-station is at Renton, nineteen miles distant, and contains an equipment similar to that at Isaquah. In the terminal sub-station at Seattle there are at present three step-down static transformers, with primaries and secondaries in delta connection, for supplying 350 volt current to the 500 volt rotary transformers. There are also four pairs of 2 phase to 3 phase lowering transformers of 300 kilowatts capacity each, and 2 pairs of 500 kilowatts each, with 2,000 volt secondaries for general lighting and power distribution, which makes the total station transformer capacity 3,700 kilowatts. They are 2 rotary converters of 500 kilowatts capacity delivering current at 550 volts, which are operated in multiple on both alternating and direct current sides. The switch-board contains the customary apparatus for controlling the transformers. For alternating current lighting and power-motor work a panel is provided for each set of 3 phase 2 phase transformers, containing two 2,000 volts automatic circuit breakers, 2 ammeters, 2 Niagara type indicating watt-meters, 2 double-pole throw switches and pilot lamps. The Auburn sub-station, thirty-one miles from the falls, contains a 50 kilowatt lowering transformer, and the Tacoma station is equipped with three 500 kilowatt transformers and two 200 kilowatt transformers, similar to those at Seattle.

TESTS ON THE 153-MILE LINE.

By the use of the plug switching boards at the generating station and at the Renton sub-station, and of paralleling switches at the Seattle and Tacoma sub-stations, it is possible to form a single continuous three phase circuit from the generating station at the falls to Seattle, back to the falls, to Tacoma, and back to the falls, a total distance of 153 miles. A short time ago such a connection was made, and the record feat of driving a motor 153 miles distant from the generator performed. The test was made to show that electrical transmission of power can be made commercially practical at much greater distances than has heretofore been contemplated.

With the 153-mile circuit open at the in-coming end, the tests were made for charging them at different voltages, the alternation (7,200) being kept constant. It was found that as the voltage increased the charging current rapidly increased ; at 22,000 line voltage it required 62 kilowatts to charge the line, at 30,000 volts 112 kilowatts, and at 35,000 volts 180 kilowatts. With the lowering transformers at the falls cut in and their secondaries open, the current required to charge the line increased ; at 22,500 volts it required 76 kilowatts, and at 30,000 volts 123 kilowatts. The voltage at the in-coming end of the circuit, with charging current only on the line, was greater than on the outgoing ; 22,500 volts out gave 24,600 in, and 30,000 volts out gave 32,100 in.

Tests were also made to determine the different amount of charging current required at different frequencies, the voltage being kept constant at 30,000, and it was found that at 6000 alternations 100 kilowatts were required to charge the line ; at 6600 alternations, 105 kilowatts ; and at 7800 alternations, 115 kilowatts.

The line was then tested for loss of power in transmitting a non-inductive load, consisting of the water rheostat at the falls at the end of the 153-mile circuit. It was found that the line voltage out was 30,000, incoming 22,500, drop 25 per cent. The amperes per phase at 1000 volts out was 624, incoming 354, loss 11.2 per cent. The total kilowatt outgoing was 1100, incoming (that is delivered into the water rheostat tanks) 723, loss 34.2 per cent.

A test was also made for charging current with the sub-station transformers at Seattle and Tacoma, and the lowering transformers at the falls in circuit, but with secondaries all open, and it was found that with the 30,000 volts out, there was 31,500 volts in, and that it required 193 kilowatts to charge the line. A test was then made of operating a second generator as a synchronous motor at the end of the circuit, and the machines were synchronized without any trouble whatever ; but they soon began pumping, so that it was found advisable to separate the machines. During this test the outgoing line voltage had varied from 26,000 to 27,600 and the incoming from 24,000 to 26,700, giving approximately a drop of six per cent., the amperes per phase at 1000 volts out being approximately 900 ; incoming, approximately, 650 ; loss, approximately, 27.7 per cent. Total kilowatts out, 432 ; incoming, 374 ; loss, approximately, 13½ per cent.

The expiriment was then tried of operating the water rheostat and the synchronous motor in multiple at the end of the 153-mile circuit, and the performance of the motor was very much improved. The water was then shut off from the water wheel and the driven motor at once reverted to a generator driven by its own inertia.

The above description, together with the accompanying illustrations, are reproduced from the Journal of Electricity, Power and Gas, of San Francisco.

A by-law will be submitted to the ratepayers of Thessalon, Ont., to provide funds with which to install an electric light plant.

Mr. A. H. Bertschinger, who has been connected with the Ottawa Electric Company for some years, has opened an office as electric contractor at the corner of Slater and Elgin streets, Ottawa.

The city of New Westminster, B. C., owns its electric light plant, and has recently adopted new regulations affecting the use of the electric light. These regulations provide that the following charges and conditions be adopted and incorporated in the agreement between the corporation and the consumers in all application for light supplied : (a) All current supplied shall be measured by meter and a rental of 25 cents per month shall be charged for all meters. (b) On all meter accounts paid at the office of the City Treasurer on or before the tenth day of each month a discount of 20 per cent. will be allowed on the previous month's account, provided all arrears due by the consumer to the Electric Light Department are paid up. Rates will be as follows : On a monthly consumption not over 30,000 watts, the rate per 1,000 watts shall be 15 cents ; over 30,000 and not exceeding 60,000 watts, 14 cents ; 60,000 to 100,000, 12 cents ; over 100,000, 11 cents. (c) All meters and the fittings belonging thereto are and remain the absolute property of the city, and are held in trust by the consumer, who hereby agrees to pay for all damage done to the said meter and to protect it from interference or removal by other than the city's officers during such time as it shall be installed within or upon the premises.

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EDITOR'S ANNOUNCEMENTS.

Correspondence is invited upon all topics coming legitimately within the scope of this journal.

The "Canadian Electrical News" has been appointed the official paper of the Canadian Electrical Association.

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The London Metropolitan Underground.

A CABLE just received announces that the contract for the electrical equipment of the Metropolitan underground railway in London, England, has not yet been finally awarded to the Ganz Company. Mr. Yerkes is said to be strongly opposed to the proposed high-voltage alternating system, and it is thought has obtained control of sufficient stock to prevent its adoption. His object is to establish a uniform American continuous current system on the Metropolitan line in connection with London's "tupppenny tubes."

An Edison Storage Battery.

EXCESSIVE weight has been a great drawback to the storage battery. Naturally, therefore, the daily press reports, which seem to be borne out by facts, that Edison has in process of completion a new type of storage battery of lesser weight, has created considerable interest, for two reasons, first, in view of the success which he has achieved in other electrical inventions, and secondly, for the reason that in late years he has almost entirely avoided the storage battery problem. According to a description which appears in a German paper, Mr. Edison's battery is not a lead accumulator, and the chemical actions in it are said to be quite different from those in the ordinary storage battery. The voltage is given as 0.44, which is a little more than a fifth of the voltage of the ordinary accumulator and corresponds approximately to that required by theory. As depolizer, the lower oxide of copper is used, and as negative electrode finely divided cadmium. Mr. Edison is reported as having stated that he would reduce the weight of the modern battery by one-half and the depreciation to one-tenth, results which, if accomplished, would give a veritable boom to the storage battery.

The School of Practical Science.

It is gratifying to state that the Ontario government have promptly responded to the request of the students and interested bodies for increased accommodation and better equipment at the School of Practical Science, Toronto. The goverment's determination to erect an entirely new building for the purpose is a wise one. The estimated cost is $200,000, but a larger sum will be expended if the requirements should demand it. The designing of a building for such a purpose will afford scope for architectural ability of a high order. Probably the most satisfactory method of procuring a carefully designed and planned building expressive of its purpose and adapted to the requirements, would be to institute a competition for designs under conditions to be approved by the Ontario Association of Architects. The government should give the winner of the competition opportunity to inspect the most important buildings of similar character in the United States, the desirable features of which should be incorporated in his plans. The determination to spend so large a sum upon the erection of a building, the equipment for which will call for a further considerable expenditure may be taken to mean that the government propose to establish one thoroughly efficient scientific school in Ontario, instead of dividing the money at its disposal between two or more institutions. We strongly sympathize with the idea. Let us have one provincial university and one scientific school which will compare favorably with those of other countries, rather than a number of such institutions

which because of insufficient revenue must necessarily be more or less inefficient.

Electricity and Industrial Development.

Of the early electrical companies practically all were organized for the sole purpose of supplying current for lighting. Later came the application of electric power for railway purposes, and following this, its more general application for power work of many kinds. While there has been an immense development in the electric lighting business, the indications are that there will be witnessed a still greater development in the application of electricity in the industrial field. To-day water powers are being developed for the production of electricity where there is no prospect of any considerable market for the current outside of industrial enterprises, the lighting demand being given little consideration. If there are any who consider that the expansion of the electrical business in Canada is nearing its crest, a study of the industrial development which is taking place, and the relation of electricity to it, will surely lead to a different conclusion. Take for example the undertakings at Sault Ste. Marie, Ont., and Shawinigan Falls, Que., where electricity has been a most important factor. Another example is to be found at the cotton mills at Valleyfield, and many others might be enumerated. Electricity is, in fact, becoming more generally employed every day, and is fast superseding steam as a motive power in industrial operations. It is even being applied to the operation of saw-milling and wood-working machinery. Pulp and paper making is another branch of industry in which electricity has been and will be even more largely used. This prospective development is most encouraging, indicating, as it does, an increased demand for electrical goods of all kinds.

Gas Engines.

Of late there seems to have been a pronounced recognition of the merits of the gas engine in connection with the operation of electric lighting and power plants. Manufacturers have given more attention to perfecting the gas engine, and have brought it to a point of development where it is now a strong rival to the steam engine. In this country it is now largely employed for purposes where a small amount of power is required; but the tendency of the times appears to be towards its more general adoption in larger units operated by producer gas. Advantages of the gas engine are that it occupies less space than an equivalent steam plant, requires less attention, and, according to the claims of the manufacturers, shows a higher efficiency. Modern engineering also inclines to the opinion that in the near future higher attainments in efficiency will be reached by the use of the gas engine than by any other means. It is significant that we find gas engines operating electric railway power plants, inasmuch as one of the chief arguments against the use of the gas engine has been its inability to regulate satisfactorily with rapidly varying loads. While on this continent the gas engine seems only to be in its incipient stage, it has undergone a much greater development in Europe. Mr. Philip Dawson has contributed a series of articles on "Some Existing Gas Driven Power Plants," from which it is learned that for over twenty years large electric lighting plants in Europe have been driven by gas engines. In 1881 the Continental Company, of Dessau, completed an installation in connection with its work containing three gas engines belted to a counter-shaft which was connected to four dynmos. A gas engine driven plant which is described as possessing features of particular interest was installed in 1894 at Zurich to operate the Zurich Bergbahn electric railway, opened for service in February, 1895. The power plant consisted of two 33-kilowatt compound-wound generators, each driven by a belt from a 50 horse-power Crossley gas engine, and supplying current on the line at a pressure of 550 volts. The same system was adopted on a much larger scale at Lausanne in 1896. In Europe there has been a constant tendency towards enlarging the size of the gas engine, also towards using it in combination with storage batteries.

Government Ownership of Telegraphs.

During last month the fact was made public that the Dominion Government have under consideration the question of assuming control of the telegraph systems of this country. The matter has not yet taken tangible form, and it is not probbale, in view of the lengthened absence of the postmaster general who is now on his way to Australia, that any action will be taken at the present session of parliament. The proposal that the telegraph systems of Canada should pass into the hands of the government is no doubt the outcome of the project to connect all parts of the empire by cable and telegraph under government supervision and control. The Canadian postmaster general is favorable to this project and to the construction of a Canadian cable. It will perhaps be remembered that Canada is the only British colony where government ownership of telegraphs does not exist, and therefore, as stated, the idea no doubt is to complete the missing link. There are difficulties in the way however. In Canada we have two commercial telegraph systems, one of which forms part and is operated in connection with the Canadian Pacific Railway. It would be a comparatively simple matter for the government to buy up the stock of the Great North-western, Dominion and Montreal Telegraph Companies, but it would be a more difficult matter to purchase the Canadian Pacific Telegraph system at a fair valuation, seeing that the business is so interwoven with that of the railway. There would probably be much difficulty in distinctly separating the receipts and expenditures of the telegraph system from that of the railway in such a way as to arrive at the actual results of the operation of the system. It is apparent that should the government take over the telegraph systems, they would be obliged to acquire the long distance telephone system as well, which otherwise would prove a strong competitor. This fact adds considerably to the magnitude of the undertaking. Mr. H. P. Dwight, president and general manager of the Great North-Western Telegraph Company, was asked, in view of his long experience in telegraph management, to consult with the postmaster general with regard to this proposal, but we understand no proposition of any kind was made by the government. The object in view was simply to obtain information which would assist the government in considering the matter. The experience of the British government with the management of the telegraph system is not encouraging, the receipts of the system being £2,000,000 per year below the expenditures, notwithstanding the large and concentrated population and the enormous volume of business. This result is no doubt in a measure due to the fact that government employees have not the same chance of promotion as have those of a private corporation, consequently ambition is stifled and a check put upon efficiency.

QUESTIONS AND ANSWERS

"R. H.," Halifax : I have been told by an agent that if I add one more wire to my single phase system the same size as the two now up and turn it into a two phase, that I can carry twice the power with the new system with the same loss. Is this correct or not ?

Ans.—The loss of power in a single phase system, each of whose wires carries I amperes and has a resistance of R ohms, is I^2R watts per wire, or $2I^2R$ for the complete line. If you add a third wire of the same cross section, making it the neutral of a quarter phase line, and put the same current through each of the two remaining lines, the current in this neutral will be $\sqrt{2}$ times that in either of the outsides, or $\sqrt{2}I$ amperes, and the loss will be $(\sqrt{2}\frac{1}{2}I)^2R = 2\ I^2R$ watts, or twice as great as that in either of the other two, which, as they are carrying the same current, will give the same loss as they did in the single phase system, namely, $2\ I^2R$ watts. The total loss in the three wires is therefore $4\ I^2R$ watts, or twice what it originally was ($2\ I^2R$ watts), so that by adding 50% more copper you are enabled to carry twice the load with twice the actual or the same percentage loss.

"A. B." writes : I have two circuits the impedances of which are respectively 4 ohms and 12 ohms ; what will be the total impedance if I put them in series, will it be just 16 ohms ?

Ans.—The impedance of a circuit is numerically equal to the square root of sum of the squares of the effective resistance and the reactance, and it is impossible to add two impedances without knowing one of the two factors which compose each of them ; generally speaking, the true sum is less than the numerical.

" Electrician " asks : What is the usual practice regarding the exciters of alternating current generators driven by water-wheel plants? Is it better to belt them to the main generator or to drive them by direct coupling to separate wheels ?

Ans.—The disadvantages of direct coupling are : Usually higher cost both for the exciter, which will usually be of a slower speed than if belted, and also for the separate wheel ; more wheels and piping to look after and maintain ; and, if high heads are used and consequently small nozzles, the great liability of choking. The principle advantages are : Greater interchangeability, seeing that the shutting down of a generator will not affect the exciter furnishing it ; the avoidance of all belt troubles ; the decreasing of the floor space occupied ; and greatest of all, the great improvement obtained in the voltage regulation, seeing that a change in the load and consequently the speed of the main machine will not affect the speed and consequently the voltage of a direct driven exciter, as it would were the latter belted to the alternator it excites. The efficiency of the two plans is about the same, the increased losses in the small wheel over those in the main wheel being about offset by the gain due to the absence of the belt losses.

" E.S.," Montreal : Can you give me any convenient rule for calculating the size of a three-phase wire. I can figure out the sizes for single-phase work without any difficulty.

Ans.—Since the three phase system takes but 75% of the copper of the single phase, it follows that the area of the 3 three-phase wires must together be equal to ¾ of the combined area of the two single phase loads, or 3 three-phase = ¾ (2 single-phase), which resolved shows that a three-phase wire is but half that of a single-phase, or in other words, for the same loss over the same length of line carrying the same load, each of the three-phase wires will be half the cross-section of either of the single phase.

"Owner" : I have recently speeded up my engine, and I find that since then we have been troubled a good deal with water in the cylinder, which has come over quite hard two or three times. We never had any trouble when running at the old speed.

Ans.—Speeding up your engine virtually means that it does more work in a given time, or in other words, that the demand for steam is greater. From this increased demand it follows that if your boiler capacity is at all on the small side you are running great chances of priming and foaming, which perhaps is what is occuring. Again your engineer may be carrying his water a little too high, which tends to produce the same difficulty ; or yet again, your steam main may be too small, or there may be a point in it, such as a valve or a flange coupling, the area of whose steam passage is too small, which in conjunction with the heavier demand for steam caused by the increased speed, will frequently make the engine draw over water from the boiler.

" S. Y.," Toronto. Would you kindly advise me the best way to make the slots in the armature discs of a small motor I am building ; there is no punch in the machine shop which I have available.

Ans.—You can buy from various makers discs punched with any style, size or number of slots, and this we think would probably be the best way to obtain them, but if you prefer making them yourself a simple method for a small machine is to charge them between the end plates of your armature which have previously had the slots filed out in them, and then using these slots as a guide, drill holes through the discs parellel with the shaft from plate to plate, cutting out with a back saw the top part left untouched by the drill, and then filing out the fillets left at the bottom of the slot.

" Student " asks : What is the difference between a current transformer and a potential transformer ?

Ans.—There is no essential difference, the principle action being exactly the same in both. The former is so called because it is used in conjunction with an ammeter to measure current in its secondary circuit in which is placed the ammeter, producing a current of low potential and comparatively small amount (approximately 25 amperes in ordinary work), proportional to the current in its primary, which latter may be either one of very large amperage, or else be in a circuit of unsually high potential, either of which conditions render it impracticable or undesirable to put this primary current itself through the instrument. The potential transformer gets its name from being used together with a voltmeter to measure potentials which are too high to allow of the latter being connected directly across them.

CARE OF BOILERS.

WHATEVER plan is adopted for securing water to feed the boilers should not interfere with the general plan of feeding at the same rate that the steam is used, so that the water line will remain nearly in the same place at all times.



ROOMS OF THE ONTARIO ASSOCIATION OF ARCHITECTS AND TORONTO ENGINEERS' CLUB, 94 AND 96 KING STREET WEST, TORONTO.

In every plant where there are two or more boilers, it is sometimes necessary to lay off one of them for cleaning or repairs. In fact, every plant should have an extra boiler to use in case of necessity, and this means whenever it is advisable to clean one of them, as the practice of running boilers almost continuously should be discountenanced on all convenient occasions.

The plan of leaving boilers empty is a good one, provided steam and water are excluded from them. This opinion is based on experience in starting up a boiler that had not been used for fourteen years, for no internal corrosion was found in it, while the external parts were but slightly affected by its long rest. It was set in brick according to common practice, two walls of the building serving as part of the setting. After it had been thoroughly inspected it was run for several years under as much pressure as a new boiler of equal diameter is usually allowed in this vicinity without calling for repairs except tightening two braces, and probably this was needed before it was laid off.

When boilers are to be left idle for a long time they should be thoroughly cleaned, as soot collects and holds moisture, so that corrosion goes on underneath the apparently harmless covering until the plates are ruined. A coat of good paint suitable for ironwork will assist greatly in preserving boilers out of use, and as the expense of it is small, it does not pay to neglect it, for good second-hand boilers are frequently wanted by parties who do not care to invest in new ones for reasons of their own ; but when corrosion is allowed to eat into the tubes and plates they will soon be fit for the scrap heap only, and are not especially valuable even there.

One advantage of a power pump and a driven well in



ROOMS OF THE ONTARIO ASSOCIATION OF ARCHITECTS AND TORONTO ENGINEERS' CLUB, 94 AND 96 KING STREET WEST, TORONTO.

connection with a good heater is that all the pumping must be done before the engine is shut down, which means that exhaust steam is passing through the heater, and no cold water can reach the boiler. An injector, says the Boilermaker, of London, is very convenient in such a plant, because it may be run to fill up the boiler after the engine is shut down.

TELEGRAPH and TELEPHONE

THE OLD TIME TELEGRAPHERS' ASSOCIATION.

The Old Time Telegraphers' Association is an international society organized about twenty years ago for the purpose, as stated in the preamble, of preserving early memories incident to the unfolding of the science and art of telegraphy. The Association has a membership of nearly one thousand, the representation from Canada being as follows : J. J. Ahearn, Ottawa Electric Railway Company, Ottawa ; Thomas Ahearn, Ottawa Electric Railway Company, Ottawa ; William J. Brown, Canso, N. S.; W. J. Camp, C.P.R. Telegraphs, Montreal ; C. D. Dewar, Bell Telephone Company, Montreal ; H. P. Dwight, G.N.W. Telegraph Company, Toronto ; R. F. Easson, G.N.W. Telegraph Company, Toronto ; J. D. Fraser, Ottawa Electric Railway Company, Ottawa ; C. R. Hosmer, Montreal ; J. E. Hutcheson, Ottawa Electric Railway Company, Ottawa ; James Kent, C. P. R. Telegraphs, Montreal; L. B. McFarlane, Bell Telephone Company, Montreal ; W. B. Powell, G.N.W. Telegraph Company, Montreal ; W. Y. Soper, Ottawa ; F. H. Waycott, Anglo-American Telegraph Company, Montreal; Thos. Rodger, G.N.W. Telegraph Company, Montreal. At the twentieth annual re-union of the Association held in the city of St. Paul, Minnesota, on September 20th, 1900, it was decided that the next annual meeting should take place in the city of Montreal in September next. Thus for the first time the Association will meet in a Canadian city. Mr. L. B. McFarlane, of Montreal, was elected to the honorable position of president of the Association for the year 1900-1901, and Mr. J. E. Hutcheson, of Ottawa, to that of vice-president. Messrs. Thomas Ahearn, of Ottawa, and James Kent, F. H. Waycott, W. J. Camp, and W. B. Powell, of Montreal, were chosen as members of the Executive Committee.



Mr. L. B. McFarlane,
President Old Time Telegraphers' Association.

Mr. L. B. McFarlane entered the service of the Montreal Telegraph Company in 1865, working his way up to manager. In 1870 he resigned and accepted an offer from the Western Union Telegraph Company at Detroit, Mich., to become night-press operator, and later was employed for the company at New Orleans and Nashville, Tenn. In 1875 Mr. McFarlane was appointed manager at Toronto for the Dominion Telegraph Company, and upon the advent of the telephone became superintendent of the Dominion Telegraph Company's telephone department. He organized and put into operation telephone exchanges in the principal cities and towns in the Dominion. Upon the organization of the Bell Telephone Company, he was appointed manager of the eastern department of that company, which position he held for sixteen years. In 1896 he was promoted to the office of general superintendent of the Canadian telephone system. Mr. McFarlane is a director of the Wire & Cable Company and the Northern Electric & Manufacturing Company.

Mr. Hutcheson is superintendent of the Ottawa Electric Railway Company. He began his telegraph career in April, 1874, as night operator at a small station on the Grand Trunk Railway, and served with that company until February, 1884, when he resigned to accept the position of train despatcher for the C. P. R. at Ottawa. In 1888 he was appointed train master of the eastern division of that system, which position he held until April, 1891, when he resigned to accept the position he now holds. Mr. Hutcheson has had the pleasure of seeing the Ottawa Electric Railway grow and prosper under his supervision. He is one of Canada's crack marksmen, having represented his country at Bisley for several years.

SUIT CONCERNING WIRELESS TELEGRAPHY.

The United States Circuit Court of New York has handed down a decision in favor of Prof. Marconi in the suit brought by Lyman C. Learned, of Boston, as the assignee of Prof. Dolbear, for damages to the amount of $100,000 and the issue of an injunction restraining Marconi from using apparatus for wireless telegraphy. The complaint set forth that Dolbear was the original inventer of the system, that his patents were issued in December, 1882, and October, 1886, and assigned to Learned in 1899. It was further claimed that the apparatus for wireless telegraphy exhibited in the diagrams of Marconi's patent was impractical, and that the defendant well knew this. It had, the complainant alleges, only commercial value when one terminal grounded was used for transmission and one for receiving, and hence contracts entered into by the defendant for commercial purposes were carried out by recourse to the plaintiff's patented instrument or instruments similar. Marconi applied similar criticism to the apparatus of Dolbear, which he claimed to be useless for any commercial purposes. He contended that his wireless telegraphy apparatus was not an infringement of the plaintiff's, which contention was sustained by the court.



Mr. J. E. Hutcheson,
Vice-President Old Time Telegraphers' Association.

BY THE WAY.

A LONDON fog is an expensive visitation. A day of it, counting the day at eight hours, is estimated to cost anything from £50,000 to £100,000 in hard cash. No small proportion of this goes to the gas and electric light companies, which have to supply about a third more power than usual. But there are also the railways. Fog signalling is expensive. At Clapham Junction alone £50 has been spent by a single railway company during a day's fog in extra pay to the platelayers.

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WHEN the Atlantic cable service was first put in operation the rate charged was $1 per letter. This charge has now been reduced to one shilling per word. It can be easily understood that in those early days the use of the cable was only resorted to in extreme cases, and the greatest ingenuity was exercised to keep down the cost. In this connection a good story is told of the late Honorable Isaac Buchanan, of Hamilton, who wished to send a message in which the word Newfoundland occurred. After a good deal of hard thinking with the object of abbreviating this word and thus cutting down the cost of the message, the honorable gentleman decided to substitute for "Newfoundland" the word "dog." The message reached its destination, but the recipient was unable to interpret it, with the result that two or three additional messages were required before an understanding was reached, and the ultimate expense was many times in excess of what the original cost would have been if the more expensive word had been first employed.

CANADIAN ELECTRICAL ASSOCIATION.

The various committees which have in hand the arrangements for the annual convention of the Canadian Electrical Association to be held in Ottawa in June, are working enthusiastically for the success of the meeting. A series of interesting papers has been promised, and other features of an interesting and instructive programme are rapidly taking definite form. The local committee of arrangements includes representatives of all the electrical companies in Ottawa and vicinity, besides a number of citizens prominently connected with other enterprises. Having the benefit of the experience of the gentlemen who so successfully arranged the Ottawa convention of five or six years ago, there is sufficient assurance that nothing will be left undone which would ensure a pleasant and profitable meeting. Persons connected with the electrical industry who may not yet have connected themselves with the Association should send in their applications to the Secretary, C. H. Mortimer, Confederation Life Building, Toronto, or to any officer or member of the Association.

MUNICIPAL OWNERSHIP.

In the course of an address delivered at the annual convention of the Northwestern Electrical Association, held at Milwaukee on January 16th, the president, Mr. P. Norcross, expressed the opinion that as municipal ownership becomes more fully understood the desire for it will diminish. Many interesting facts, he said, were contained in a report made by a committee appointed by the National Association of Officials of Bureaus of Labor Satistics in the United States. In one municipal plant there were eight private arc lamps of 1,200 candle and ten street lamps. The users of the eight private lamps were obliged to pay the city 12 cents per kilowatt-hour, while the city paid nothing for its ten street lamps. In other words, a few enterprising citizens paid for their own light five or six times as much as they would have paid to a private lighting company, and carried the entire burden of lighting the entire city's streets, which should have been borne by all of the taxpayers. In another plant the cost to the city of operating 75 street lamps was over 12½ cents per kilowatt-hour. In contrast to this a private company was mentioned which furnishes the city and private users light at the uniform rate of 2½ cents per kilowatt-hour.

MONTREAL

Branch office of the CANADIAN ELECTRICAL NEWS,
Imperial Building,

MONTREAL, APRIL 5TH, 1901.

The Quebec Legislature have passed the bill incorporating the Montreal Light & Power Company, and having given some privileges hitherto unknown, naturally has raised public discussion here. If, however, the point is well looked into, the public have not much reason to kick. In regard to the streets, is it possible to make them any worse than they are at present? Will a few more poles, seeing what are up already, do any further harm or make the streets look any worse? Montreal has a good number of electrical workers idle, and this new work will provide situations; and as it is financed by men of excellent reputation and capable financiers, Montreal surely will not be the worse in the long run for their enterprise. Quebec looks to the government to put through any new schemes, but Montreal has to look to the enterprise of her own citizens, then why frown down their schemes when the whole cry heretofore has been, "Oh, for more enterprise?"

Citizens on the St. Catherine line of the Montreal Street Railway are so pleased with their new double-truck cars, that the "Windsorites" are jealous and longing for their turn. Now that the Chambly dam is prepared sufficiently for the railway to have some additional power, it is hoped the turn will come soon.

The dam having been sufficiently repaired at Chambly, power was turned on again last week, and the Royal Company were enabled to dispense with auxiliary plants at Montana street, Chenneville street, etc., which they had requsitioned into service at the time of the break. It is said that the Montreal Street Railway Company are now getting from that source 500 h. p., to be further increased shortly. This is, of course, in addition to their own power from steam power house on William street.

The new Montreal Light & Power Company are adding to the generator capacity at Chambly power house, the additions to be Westinghouse apparatus, and voltage now will be 20,000 stepped up by transformers and not taken directly off the generators, as was the case with the original S. K. C. generators, current from which was taken off at 10,000 volts. The step down station will be at the Royal Company, as before. This doubling up of voltage will, of course, give them greater carrying capacity on their lines, and it is evident that they intend selling electric current on an extended scale or certainly the expense would not be gone into. It also shows that they have got their present plant well loaded up.

The Lachine Rapids Hydraulic & Land Company seem to have stood off going into the combine, at least for the present. This still gives us a measure of competition in Montreal, and as has been said of the new U. S. steel trust, "sometimes the works with small output can hold the large ones to a price."

NOTICE TO SUBSCRIBERS.

Subscribers who may change their addresses on the 1st of May are requested to advise us of the fact, and send us promptly their new addresses, thus insuring correct delivery of their papers.

The first legal step in the electric light trouble at St. Catharines, Ont., was taken a few days ago, when the old board of directors took out an injunction to prevent Mr. Nihan's board of directors from transacting any of the company's business.

ELECTRIC RAILWAY DEPARTMENT.

THE LANGEN SUSPENDED ELECTRIC RAILWAY.

An engineering work which has attracted much attention, and which differs from anything to be found in this country, is the Langen mono-rail suspended electric railway, operated between Barmen, Elberfeld, and Vohwinkle, near Colonge, in Germany. The system consists essentially in the employment of a single rail fixed to the under surface of a viaduct, which latter is supported by light lattice work construction. As shown by the illustrations, the wheels roll above instead of beneath the cars. The machinery which we are accustomed to see beneath an electric car is located upon the top, and a remarkable fact is that the wheels roll anced directly beneath the propelling wheels, which form the only support for the hook connections. The ties of the wheels are grooved or hollowed out to a depth of about an inch so that they grip the rail. The weight of the car acts as so much ballast in holding the wheels on the rails, and the grooves prevent them from slipping off, although to the observer it appears as if a car might break away from its fastenings and fall at any time.

To each truck are fastened two wheels one behind the other, the electric motor being placed outside and between the wheels. The electric current is carried through the motor by means of a trough or shoe which slides along a smaller rail charged from the power

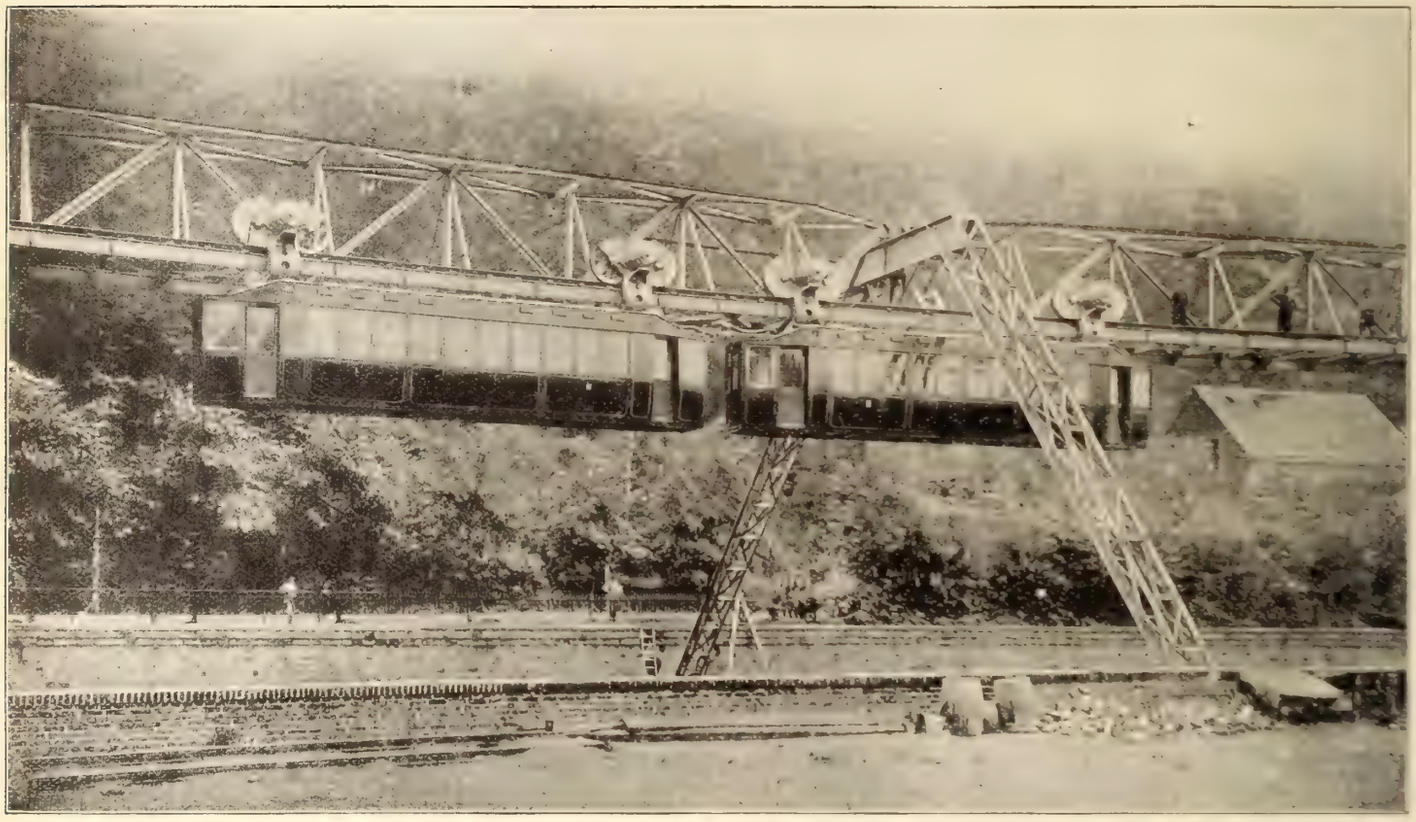


Fig. 1. The Langen Suspended Electric Railway.

along a single rail instead of two. One rail railways have been constructed before, but the cars have always been above and kept from falling over or leaving the rail by wooden or metal beams which formed a cradle or channel through which they ran. On the Barmen line the cars have no lateral supports whatever.

The length of the road is eight and one-quarter miles. Six miles of the line pass over the Wupper river, a tributary of the Rhine, which varies in width from sixty-eight to one hundred and fifteen feet. No satisfactory route existed for a surface road, and it was deemed impracticable, on account of the expense and engineering difficulties, to construct an ordinary type of elevated railroad. The adoption of the hanging system was recommended by the engineers of the Electritats Aktiengellschaft, who estimate the total cost of the road to have been $2,500,000.

Steel castings, curved like huge hooks, are bolted to the upper frame-work of the car and connect it with the motor trucks on the rails. The centre of the car is balhouse. The motors are rated at 36 horse power at 500 volts. The currents supplied to the up and down track are separate, and a large storage battery is installed at the central station. In the case of a train of two or more cars the first car alone is fed directly by the current, a flexible cable of several wires supplying the necessary current to the other cars for motors, incandescent lamps or bells. Each car has a motor equipment. Westinghouse air brakes are used, the reservoirs being refilled at the terminal points of the line.

Curves can be managed with but slight oscillations, in fact, curves with a radii of 50, 25 and 10 metres have been passed over with speeds of 41, 30 and 16 miles, deflecting the cars by 35, 36 and 27 degrees, and still no motion was felt by the passengers. The sharpest curve of the track proper has a radius of 205 feet. The cars are 37 feet long by 6.5 feet wide, and accommodate fifty passengers each. Two telephone wires are attached to the structure, and by means of a bamboo pole, carrying metal clips, connection can be made from any

car to the power house and various stations on the line Automatic ticket vending boxes are used.

The structure is about twenty-five feet above the street level, and the lowest portion of the car about 15 feet. The weight of the car, with its load of fifty passengers, is estimated at fourteen tons, made up as follows :

Two electric motors with complete electrical outfit..	6,743 lbs.
Two bogies with buffers and cross beams	3,960 "
Car body with seats complete	12,903 "
Passengers	7,700 "
Total.....	31,306 lbs.

The superstructure itself weighs 700 pounds per foot. The supports are placed at an average distance of 100

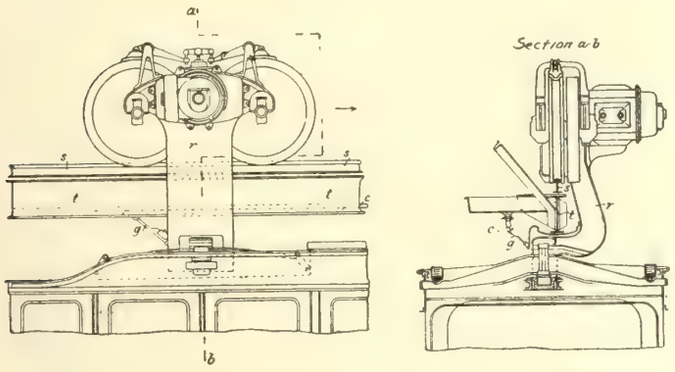


FIG. 2– DETAILS OF SUSPENSION TRUCK, LANGEN SUSPENDED RAILWAY.

feet apart. It is proposed to run the cars at a speed of thirty miles per hour, thus the average speed including stops will be about twenty miles. Trains of two cars run under a headway of two minutes, and are controlled by an automatic block signal system. It is estimated that with trains of four cars six thousand persons can be dispatched per hour in either direction.

The road was put in operation on October 24th, 1900, the work of construction occupying about two years. It is understood that some six thousand engineering drawings were prepared in connection with the installation.

AMERICAN STREET RAILWAY ASSOCIATION.

The twentieth annual meeting of the American Street Railway Association will be held in the city of New York on October 9, 10 and 11. The Madison Square Garden has been leased for one week, and it is expected that the exhibit of street railway appliances will be on a very large scale. The Street Railway Accountants' Association of America will also convene, as usual, simultaneously with the Street Railway Association.

Among others, papers will be presented on the following subjects : "The Value of Storage Batteries as Auxiliaries to Power Plants" ; "The Public, the Operator and the Company" ; "The Best Manner and Mode of Conducting the Return Circuit to the Power House" ; "The Economies Resulting from the Use of Four Motors instead of Two on Double Motor Equipments" ; "Practical Results Obtained from Three-Phase Transmission and Rotary Transformers or Motor Generators in Transmitting Power on Railway Lines" ; "The Modern Power House, including the Use of Cooling Towers for Condensing Purposes."

Messrs. Pocock & Russell, of Hamilton, have invented a friction brake for steam and electric cars, by which it is claimed a car can be stopped within a very few feet when running at high speed. The principle is a friction shoe applied to the wheels of the car.

SUNDAY CARS IN ST. JOHN, N. B.

An attempt by the Sabbath Observance Association of St. John, N. B., to prevent the running of street cars on Sunday, has failed, because of an adverse ruling by the police court. Complaint had been made against several motormen who were operating cars carrying passengers, and the street railway company moved for their dismissal on the ground that the street railway was exempt under the Sabbath Observance Act. Section 1 of this act provides that it shall not apply to persons carrying travelers, and the case turned on whether street railway passengers could be considered travelers within the meaning of the act. The principal difficulty was to determine the length of a Sabbath day's journey. The local authorities in matters ecclesiastical could give no assistance, but finally a case was found in the law books where a Sabbath day's journey was defined as 2,000 paces, or about three-quarters of a mile. Under this ruling the judge dismissed the complaints, holding the company's point as to passengers being travelers to be well taken.

SPARKS.

It is announced that the Montreal Street Railway Company have acquired the Montreal Park & Island Railway, and that extensive improvements will be made to the road.

Conductors employed by the Brooklyn Rapid Transit Railway Company, of Brooklyn, N.Y., are now required to furnish bonds for $500 as a safeguard to the company against dishonesty. It is alleged that the shortage of fares among the 3,345 conductors employed in the various lines has in the past amounted to a large sum daily.

A recent Ottawa paper calls attention to the fact that the great value of the work done by Ottawa in electric railway enterprise related particularly to the snow problem confronting the Canadian cities between Kingston in the west and Quebec in the east. Prior to 1890 it was generally considered impracticable to operate wheeled cars upon tracks in the streets of Quebec, Montreal or Ottawa, which cities experience greater winter storms and depths of snow than any other cities upon this continent. The

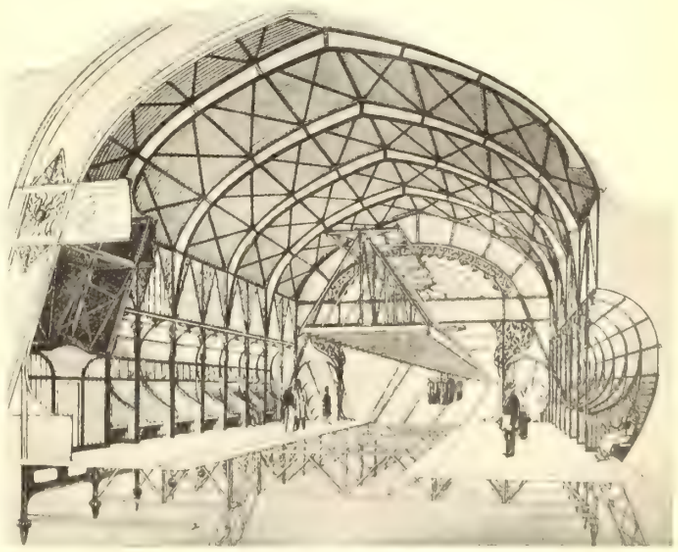


FIG. 3– INTERIOR VIEW OF STATION, LANGEN SUSPENDED RAILWAY.

manner in which Messrs. Ahearn & Soper overcome the obstacles was eagerly watched by the managers of the Montreal Street Railway Company, and as a result the example set by Ottawa was followed in Montreal. This debt of gratitude was gratefully acknowledged a few years ago in the Railway Committee of the House of Commons by the Hon. Mr. Brodeur, the present Speaker of the House of Commons, who stated that to the example and success achieved by Ahearn & Soper at Ottawa was due the fact that electric cars were adopted in Montreal. Mr. Brodeur spoke authoritatively, being for many years one of the solicitors for the Montreal Street Railway Co.

ENGINEERING and MECHANICS

INSUFFICENT BOILER CAPACITY.

In the discussion over the plans for abating the smoke nuisance in Chicago, an interesting contribution is made by an engineer, employed in a small plant, who describes the conditions which obtain in his boiler and engine room, and likewise, he declares, in a large majority of similar plants throughout the city. Reviewing the opinions expressed by several prominent local engineers, he says :

They one and all told you these three things—that bituminous coal on first exposure to intense heat gives off great volumes of black smoke, that our present appliances for its combustion are so imperfect that it is impossible to consume all this smoke, and that careful firing would do away with a large per cent. of it—and give the impression to the general public that, after all, the firemen are to blame for most of the trouble. Undoubtedly this is true in the plants presided over by these chief engineers, and probably it is also true in a number of the large down-town blocks and the large modern manufacturing plants, but if you want to get the true reasons for most of the smoke you complain of so constantly and bitterly, get out among the engineers and firemen who actually shovel the coal—the men who make the smoke—and then you'll get at the root of the matter.

He declares that the smoke nuisance is the result of inadequate boiler capacity and overworked engineers and firemen, and points to the files of the Society for the Prevention of Smoke for proof of this assertion. This society employed skilled men to visit and inspect steam plants and find out just why dense smoke was allowed to pour from the chimney, talk the matter over with the engineer and proprietor and suggest remedies. If they were unreasonable and refused to do anything the society intended to arrest and re-arrest them till they were glad to apply the remedies. They found instead that the smoke was mostly due to inadequate boiler capacity and overworked engineers and firemen and they had no remedy. If a boiler is not big enough to furnish the required steam without crowding the fire from morning till night there is no possible way to keep it from making a dense smoke. If a boiler with constant care and attention could possibly be made to produce the steam without undue smoke, in nine cases out of ten the engineer, who also does the firing, is required to do other work around the place, which prevents him from giving his fire proper attention. If a plant has a battery of, say, four boilers and really ought to have five or six, and employs only one fireman, as in plenty of places in Chicago, and this one man has to shovel from twelve to sixteen tons of coal under these boilers daily, take up and wheel out his ashes and look after his feed pumps, how would the "single shovel method" work?

Some of the examples cited are interesting and instructive. The public is asked for an expression of opinion on the following cases which are said to be typical of many in Chicago to-day :

What do you think of a 200-room hotel with only two boilers to run the heating system, elevators, laundry, etc., when the engineer does his own firing, wheels all coal from the front under the sidewalk to the rear, where the boilers are, is responsible for the hydraulic elevator pumps, feed pumps, laundry engines and machinery, and is expected to leave his engine room to go to any floor in the house to repair the heating system, electric lights, hydrant faucets, etc., any time he may be called on ?

What do you think of a plant where the engine and boiler are in one corner of a 100-foot basement where the engineer is expected to keep up steam, run the engine, pumps, injectors, etc., all day, receive and put away all goods that are stored in the basement, keep accurate account of them, and give them out as called for, keep the floor swept and the whole basement clean and neat, have charge of and keep in repair the heating system of five floors, run two small machines eighty feet from the engine that have to be operated at least two-thirds of every day and do all the carpenter work for the building that can be done in the basement and then aken where it is to be set up and used ?

Many engineers who have been questioned on this subject say hat the picture presented in the foregoing description is not overdrawn.—Modern Machinery.

Every steam plant should be fitted with more than one boiler eeder.

SMOKE PREVENTION AND BOILER RATING.

THE proceedings of the Engineers' Society of Western Pennsylvania, just issued, contains the recommendations of the committee on smoke prevention and boiler rating as follows :

In the matter of rating of steam producing plants, the following three divisions were discussed : (1) Heating surface per horse power ; (2) great surface per horse power, and (3) amount of draft. The committee did not think it wise to recommend any fixed amount of heating surface per horse power, partly because some boilers are working economically with less than the usual surface usually recommended per horse power ; that is, for a horizontal tubular 12 square feet, and for a water tubular 10 square feet.

In regard to the area of grate surface per horse power, the committee recommends the following ; (1) Run of mine, one-sixth to one-fifth square foot per horse power ; (2) slack, bituminous anthracite, one-fourth to one-fifth square foot per horse power, the air space in the grate being taken at 50 per cent. For mechanical stoking the rate should be the same.

Regarding the third matter the committee finds that in all cases the draft should be measured not in the stack nor in the ashpit, but in the furnace over the fire and with the furnace door closed and the ashpit door open when working the grate at the above mentioned rate. When thus measured in unfavorable weather the minimum should be three-eighths of an inch for run of mine and one-half inch for slack.

Regarding smoke prevention the committee reached the following conclusions :

1. In an ordinary furnace, smoke may be made very light by very careful hand firing, yet in practice this cannot be obtained continuously, and the use of special furnaces or appliances should be insisted on and made compulsory by law.

2. The best method of preventing smoke is to burn the fuel in a separate chamber, so that the combustion is complete before the gases touch the surface of the boiler.

3. Where this method is not practical, as in boilers already set and where there is no room, the best results are obtained by mix ing the smoke, as it passes from the furnace with heated air, the effect of which increases the temperature of the smoke as the temperature of the air increases, thus burning the smoke.

4. That as, even with special furnaces of the above types, with hand firing, the combustion is irregular and hence some smoke must be produced at times, the use of mechanical stokers is strongly recommended, especially in all plants above 100 horse power.

5. As mentioned above, there is a lower limit of grate area per horse power below which the furnace is not heated enough to insure complete combustion and smoke is thus produced. For this reason all plants should be subdivided into two units at least, in order that the boilers may never run at a lower activity than one-third of their rated horse power.

SAVING AND WASTE IN SMALL STEAM PLANTS.

An interesting case of improvement in the economy of a small power plant has recently come before our notice, says the Engineer, In the plant in question steam was required to heat a small building and to supply an engine developing some 20 to 30 indicated horse-power for about 10 hours per day. For this purpose two boilers were employed, one an old type heating boiler furnishing steam at low pressure for heating purposes, and the other an old and decrepit tubular boiler for the engine. A good grade of stove coal was burned in each costing about $5 per ton. Under these conditions the daily consumption of coal during the winter months was about one ton. In due course of time these old boilers were taken out and replaced by a modern boiler of the usual fire tube type. The grate of this boiler, both in extent and form of grate bar, was designed for rice coal instead of the more expensive fuel which had been previously used. At the same time the engine, which was simple and non-condensing, was arranged to deliver its exhaust into the steam heaters, and thus to utilize the exhaust steam for heating purposes instead of throwing it away entirely, and then providing by a separate boiler the steam reqired for the heating.

Under the same general conditions as before and without further

engineering refinement, the consumption of fuel has been reduced to about one-half ton of rice coal as compared with the ton of stove coal formerly used. This means a net saving of about $4 per day in the fuel account. During the summer months the saving will be less, but it is within the limits of probability to count on a saving of about $1,000 per year simply in the fuel account.

With some further improvements, such as an exhaust feed water heater, improved non-conducting covering for the boiler and piping, a still further saving may be expected.

It may, of course, be said that the first conditions were excessively wasteful, and such indeed was the case. At the same time there are only too many just such wasteful little steam plants scattered throughout the length and breadth of our land, and while in many of them conditions would not permit of so large a relative financial saving as that described above, still the illustration given may be taken as a fair example of what may be saved under conditions of this general character. Again it may be noted that the new plant referred to is by no means in the front rank of engineering practice. The installations, old and new, in fact involve only the simplest of every day engineering, and may be taken as a good illustration on the way money may be wasted or saved in the fuel account of an ordinary small steam and power plant.

HINTS FOR ENGINEERS.

An asbestos plug cock makes a very good blow-off cock. Engineers used to argue concerning the advisability of turning the plugs of these cocks more than one-quarter revolution, but such discussions were suddenly cut off by the appearance of plugs that could not be turned more than 90 degrees.

Many of the valves found in modern steam plants have removable discs, so that when one leaks it can easily be repaired. A supply of these discs should always be kept on hand, as it may not be convenient to buy one when it is wanted.

When an engine runs "under," it always has an awkward appearance.

If you are not paid as much money for running your engine as you consider the job worth, do not fail to keep the plant in first-class condition, for visitors will not stop to inquire how much salary you receive.

When calculating the speed of an engine, begin with the governor pulley, just as if it were the driving pulley on a shaft.

If it is necessary to use the common globe check valves, when piping up a steam plant, use one size larger than the pipe, as they will work with less friction.

Leaky boiler seams should never be calked with steam pressure on the boiler.

One hundred pounds of wood are equal to forty pounds of good coal, so far as steam-making qualities are concerned. A cord of hickory wood is worth much more than a cord of chestnut, but the latter does not weigh as much as the former, so that for equal weights, there value is equal. It is assumed that the wood is thoroughly seasoned.

Before you attempt to carry your indicator box away by the handle, be sure that the lid is locked or hooked, as otherwise you may find the indicator on the floor.

An injector requires steam for its successful operation; hot water will not answer the purpose.

Ground joints on cylinder heads of steam engines are good things, as they save packing and trouble, but they must be used carefully when taken apart, as it does not require much to make them leak. Before they are put together both surfaces should be well cleaned, and treated with cylinder oil.

Locate the blow-off valve as near your boiler as possible.

Plumbers often use wax for making joints on gas pipes, in order to prevent leaks, but red or white lead will do for ordinary work; if there are small leaks the joints may be varnished.

When fitting up a water tank for use in the upper story, or perhaps on the roof, locate the outlet pipe in the side near the bottom. Do not let it project on the inside, but have it funnel-shaped, with the inner end flush with the inside of tank. That is the way to secure the greatest efficiency; in other words, the proper way to get the most water through the pipe in a given time.

When an engineer thoroughly understands the machine that he has charge of he has made a good point, but he can not claim to be well informed in the business until he has a good working knowledge of several other kinds. He should also study up the man who owns the machine he is running, for failure to do this may result in complete dissatisfaction, when he in reality is a competent engineer.

When it is desired to connect into a pipe say 2 inches or less in diameter, it is frequently cheaper to break a cast iron L than to disconnect several joints.

If you intend to use a heavy cylinder oil in a cold place, buy a downward-drop lubricator.

Be sure to close the drip cocks on your engine when it has attained full speed.

The tensile strength of a rivet is usually much greater than its shearing strength, but this is counterbalanced by the fact that when two boiler plates are riveted together, the friction which must be overcome before they can be torn apart, is very great.

Do not roll sheet packing into a bundle of small diameter, but spread it on a broad shelf.

Some pumps have hand levers to start them with in case the valve gear fails to work, while others have none because it is claimed that none is needed. I prefer the former.

It is a good plan to let your engine exhaust into your heating system, but it is not necessary or advisable to have the inner surface of the pipes coated with the dregs of cylinder oil. It is well to put a separator in the exhaust pipe and locate it near the engine.

Do not do anything to discourage yourself. This means that if you are an engineer, striving to keep and old plant in good order, do not count the hours you work each week (unless you are fortunate enough to be paid by the hour), for they may mount up to an alarming figure and so operate to dishearten you.

Heating by direct radiation means that the radiators are located directly in the rooms to be heated.

Rosin makes a very poor belt dressing.

Do not attempt to tighten the nuts on a flange coupling under steam pressure.

What a great number of reasons are given for boiler explosions as we hear of them from day to day! If all were correct it would prove a steam boiler to be a very complicated and unsafe thing to handle, or work around, but fortunately some of these reasons do not exist outside of the fertile brain of those who exploit them for their own benefit. A boiler explodes because it is not strong enough to stand the pressure that is put upon it, and that covers the whole ground. The boiler may be new, with defects that render it at once unsafe, and when working pressure is put upon it there is trouble, or it may be old and gradually grow weaker until it fails under an ordinary pressure. Of course, it takes an experienced engineer to tell when it has become unsafe, but there is nothing supernatural about it, as some people would have us believe.—H. W. Wakeman, in The Wood-Worker.

DUPLEX TELEPHONE LINE IN JAPAN.

Some time ago the Japanese government caused to be installed two metallic-circuit telephone toll lines between Yokohama and Tokio, a distance of about 15 miles. The traffic soon exceeded the capacity of these lines, and in default of a government appropriation for a third line, it was decided to duplex the two existing ones. To do this the repeating coil at each end of either circuit (four in all) was split at the middle point of its primary winding, and a wire placed connecting these two points in the two coils at Yokohama, and a similar connection between the two coils at Tokio. In each of these cross-connecting circuits was placed the ordinary microphone and telephone apparatus. Thus a third circuit was obtained, the two legs of which were double, each leg embracing the two parallel wires of one existing metallic circuit. Interference and cross-talk between the new instruments and the others was thus neutralized in each circuit. The duplex arrangement has been working satisfactorily since its installation.

A great telegraph case is before the Court of Appeals in Toronto. The plaintiff is George Morrow, a Boston broker, and he is suing to set aside a transfer of stock in the Montreal Telegraph Company to the Great Northwestern Telegraph Company, whereby the Western Union Telegraph Company secured control of both companies. He failed before the lower court. It is said that $20,000,000 of securities are directly and vitally involved in the result of the action and appeal. It is claimed, incidentally, by the plaintiff that the Great Northwestern Company is not earning the eight per cent. dividend it pays annually to the Montreal Telegraph shareholders, and that the Western Union is making up the deficit and charging it against the Canadian companies.

SPARKS.

Hugh McColl, electrical contractor, of Ottawa, is announced to have assigned.

An agitation is on foot to have the streets of the village of Embro, Ont., lighted by electricity.

Mr. John Ganter has been appointed engineer of the water-works and electric light plants at Woodstock, N. B.

Mr. Simmons, electrician of the electric light plant at Huntsville, Ont., has tendered his resignation to the council.

The electric light plant of the Fraserville Company at Riviere du Loup, Que., was destroyed by fire early last month.

The ratepayers of Dresden, Ont., have voted in favor of borrowing $10,000 on debentures to purchase an electric light plant.

The Guelph Street Railway Company has secured a charter for an electric road to Hespeler, via Puslinch lake, and to Berlin.

Hull Bros. & Company are building a large block at Calgary, N. W. T., and purpose installing an electric light plant in the building.

A by-law will be submitted to the ratepayers of Lindsay, Ont., at an early date to provide for installing a municipal electric light plant.

It is reported that work will be commenced in the spring on the extension of the Hamilton Radial Railway from Burlington to Oakville.

The town of Yarmouth, N. S., is seeking authority from the provincial legislature to borrow $10,000 for the purposes of electric lighting.

The city council of Victoria, B. C., have recently purchased some arc lamps for street lighting from the Gregory Electric Company, of Chicago.

Messrs. Breck & Halliday have secured the contract for wiring the new drill hall at Kingston, Ont., for 185 incandescent and 8 enclosed arc lamps.

Mr. Roderick J. Parke, electrical engineer, recently gave before the Engineers Club, of Toronto, an interesting talk on "The Application of Electrical Power to Manufacturing Purposes."

The Nelson Tribune says that an electric power and lighting plant of a capacity of 1,000 h.p. is to be erected at Three Forks, Slocan, B.C., by Mr. J. M. Harris, a principal owner of the Recco mine, Sandon.

It is said that the village of Glace Bay, in Cape Breton, will install an electric light plant during the coming summer. It is also understood that an electric railway between Glace Bay and Sydney is mooted.

The Amherstburg Electic Light, Heat & Power Company have re-elected the following officers: N. A. Coste, president; John A. Auld, vice-president; W. H. McEvoy, managing director; F. M. Falls, secretary treasurer.

The demand for office accommodation in the vicinity of the recent great fire in Montreal has induced the Great North-Western Telegraph Company to fit up for office renting purposes the top storeys of their building.

Mr. J. Beck lost his life recently in the works of the Canadian General Electric Company at Peterborough, Ont. While interested in his work he unthinkingly lowered his head, which was caught between two pieces of iron which came together, causing almost instant death.

Tenders have just been taken for the erection of a boiler house and for the steam heating and electric power plant for a central heating system for Queen's University at Kingston, Ont. The architects of the work are Messrs. Symons & Rae, 15 Toronto street, Toronto.

The Peterborough Hydraulic Power Company has been incorporated, with a capital of $50,000 and head office at Peterborough, Ont., the object being to develop a water power. Hon. George A. Cox, of Toronto, and Mr. W. G. Morrow, of Peterborough, are among the promoters.

The town of Digby, N. S., may ask authority from the Legislature to borrow $40,000 for the purpose of buying out the electric light plants at Bear River and Digby, and using the present water power of the Bear River Company to supply the above named towns with electric light and power.

Mr. Harold Fraser, the new manager of the electric light plant at Brockville, Ont., made a verbal report to the commissioners a few weeks ago, in which he recommended the installation of new generators for power, arc and incandescent purposes, and the purchase of new wire, poles, insulators, etc. He estimates the cost of the proposed improvements at $2,500.

Mr. W. E. Stevens, barrister, of Aylmer, Ont., has made application to the Ontario Legislature for the incorporation of the London, Aylmer and Port Burwell Electric Railway Company, to construct an electric railway connecting the points named, passing through the counties of Middlesex and Essex.

The New York Journal makes the announcement that Edison has invented a storage battery which will be able to produce power so cheaply that coal will be worth little more than sand. It is stated that he has been working on the battery for years, and expects to have it in commercial shape by next fall.

The Electric Lighting Company at Portage la Prairie, Man., are negotiating with the corporation for a renewal of their lighting contract. The council is willing to pay $1,600 for the present lighting service for one year, while if a contract for a longer period is given a number of improvements to the plant are demanded by the town.

The village of Carleton, a suburb of St. John, N. B., has been lighted electrically by D. W. Clark & Sons, who have in addition supplied houses and stores in Carleton and Lancaster. The city now proposes to acquire the franchise of this firm and will likely purchase their plant. The project of building an electric railway in Caleton may also be taken up by the city.

Mr. T. A. Stephen, on behalf of a company, has applied to the town of Edmonton, N. W. T., for the charter of the Edmonton Street Railway Company, now held by the town. This charter was obtained in 1894 and was for a street railway, with power to build from Strathcona to Edmonton. The intention of the present company is to apply for an extension of the charter so as to take in the municipalities within a radius of 25 miles of the town.

The Canadian General Electric Company have purchased a a tract of 30 acres of land at the crossing of the Northern and C.P.R. railway lines, Toronto, on which it is the intention to erect an extensive foundry. The first building to be erected will be a large general foundry, to be followed by a pipe foundry, machine shops, structural iron shops, blacksmith's shop, power house, store house, etc. Railway tracks will be run through each building, and electric cranes will be provided for handling work up to 50 tons. All the machinery in the shops will be operated by electric motors. The equipment will be of the most modern character, as representatives of the company have recently visited the leading manufacturing centres in the United States acquiring information as to the latest and best methods of shop construction. It is expected that the work of construction will begin in the early summer.

MOONLIGHT SCHEDULE FOR MAY.

Day of Month.	Light.	Extinguish.	No. of Hours.
	H.M.	H.M.	H.M.
1....	2.15	4.15	2.00
2....	No Light.	No Light.	
3....	"	"	
4....	"	"	
5....	P.M. 7.30	P.M. 10.30	3.00
6....	" 7.30	" 11.15	3.45
7....	" 7.30	" 11.50	4.20
8....	" 7.30	" 0.30	5.00
9....	" 7.30	" 1.30	6.00
10....	" 7.30	" 2.00	6.30
11....	" 7.30	A.M. 2.30	7.00
12....	" 7.45	" 3.00	7.15
13....	" 7.45	" 3.45	8.00
14....	" 7.45	" 4.45	8.00
15....	" 7.45	" 3.45	8.00
16....	" 7.45	" 3.45	8.00
17....	" 7.45	" 3.45	8.00
18....	" 7.45	" 3.45	8.00
19....	" 7.45	" 3.45	8.00
20....	" 7.45	" 3.45	8.00
21....	" 7.45	" 3.45	8.00
22....	" 10.00	" 3.45	5.45
23....	" 10.30	" 3.45	5.15
24....	" 11.00	" 3.45	4.45
25....	" 11.30	" 3.45	4.15
26....	" 11.50	" 3.30	3.40
28....	" 0.10	" 3.30	3.20
29....	A.M. 0.45	" 3.30	2.45
30....	" 1.15	" 3.30	2.15
31....	No Light.	No Light.	
		Total....	148.50

A METHOD OF CHARGING FOR ELECTRICITY.

At a meeting of the North-Western Electrical Association held January 16th at Milwaukee, a paper suggesting a method of charging for electric service was read by Henry L. Doherty, an abstract of which is herewith presented.

There are but two distinct ways of charging for electric service: First, flat rates; second, meter rates. Abstractly, flat rates are preferable, being an advantage to the station if properly imposed rates are given, but even then such rates are liable to drive away much profitable business. Meter rates cannot be placed so high but that loss may result, as a consumer's costs to the company will not equal his total payment, even if he pay $1 per kilowatt. The inequity of flat rates need no comment. Payment based on meters is often more inequitable than flat rate basis, because of difficulty of not knowing the maximum demand that the station must be prepared to supply. Charging a fixed rate per kilowatt-hour on meter basis bears no relation to cost of service. Cases may sometimes be best illustrated by exaggerations. Suppose you should receive an application for a 2,000-light connection to be used as a relay in case of a break-down of an isolated plant. At what rate per kilowatt could you afford to supply the applicant with current? This is the same problem which confronts us on a modified scale with each consumer.

Our costs are fixed by:

1. The number of consumers we have.
2. Distance from the station.
3. Capacity they demand.
4. Amount of their consumption.

The proposed system is stated as follows: There are costs such as bill making, and meter reading, which are fixed by the number of consumers or meters, and many other costs that are fixed by the number of consumers or meters we must care for, such as meter testing and maintenance, office rent, complaints and gratuitous work, superintendence and inspection. To cover such expenses, I propose to have a fixed charge for each consumer, regardless of his consumption or the size of his installation, provided no more than one meter is installed. There are certain other costs which are fixed by the capacity demanded, such as interest on investment, transformer losses, maintenance, depreciation, etc. To cover such expenses I propose to have a fixed charge for each lamp the consumer's connection will permit him to demand, without regard to the number of lamps installed or amount of current used. There are other charges which are fixed by the quantity of current generated, such as boiler fuel, lamp renewals, etc. To cover such expenses as these, I propose to charge a fixed and uniform rate per kilowatt-hour consumed. Outside of boiler fuel and lamp renewals, your operating costs would not be greatly increased if you operated twenty-four hours per day at your maximum load, nor would they be greatly diminished if you operated but five minutes per day, at your maximum load, assuming, of course, that you stood ready to serve current at any time throughout the twenty-four hours should it be called for. A charge for "readiness to serve" fixed on this basis and a low kilowatt-hour rate will bring about many advantages to the central stations, and protect them from loss, unprofitable patronage, and, I believe, will protect them from undesirable legislation. Any change in methods of charging will cause trouble, if enforced suddenly on those consumers whose bills it will increase, but this system can be used in place of horizontal reductions in the rate now charged, and can be reasonably exacted from new consumers, and eventually made universal. Evolution, not revolution, must be the policy of all quasi-public corporations. In view of the fact that it will be inadvisable to enforce this system on old consumers, who will be injured by its adoption, I propose to adopt it first as a substitute for all special rate consumers, and also for non-consumers. Instead of dividing my expenses as they exist to-day and apportioning them amongst the consumers on this basis, I expect to adopt such charges as will benefit long-hour, and therefore profitable consumers, to such an extent as can be readily compensated for by the additional business which can be secured with a lower rate per kilowatt-hour. I will continue the rate cutting by small steps, so long as I can protect the company's net earnings from marked shrinkage.

In one station, where we have been experimenting, we are convinced that it is more profitable to supply consumers on this rate system, making a fixed charge of $6 per consumer per year, plus $1.80 per lamp demanded per year, to which is added 4 cents per kilowatt-hour. for current used, than to sell at a straight rate of ten cents per kilowatt-hour. Consumers will be more liberal in the use of current when supplied at 4 cents than at 10 cents per kilowatt-hour. My plan is to make all contracts for a year or more, allowing the consumer to contract for any capacity he may choose; the capacity to be increased whenever he desires, but not to be decreased except at the expiration of the period contracted for; the capacity to be limited by a suitable maximum demand cut out to prevent him demanding more capacity than he contracts and pays for, and one-twelfth of the fixed charge to be included in each monthly bill. This system, I believe, can be rendered absolutely uniform, both for light and power, and will prove more equitable than any other system. A reduction of the kilowatt rate should be made for current supplied for power purposes, to compensate for higher costs for lighting service, owing to the exact degree of regulation necessary, and the cost of lamp renewals, which is a more important item than is generally believed. This system is free to be used as described, or can be modified to suit. It is in use in one central station and has been partially adopted in two other central stations.

ILLUMINATING POWER OF ACETYLENE GAS.

Recent experiments have shown, says the Electrical World, that the illuminating power of acetylene gas after being stored five months in a gas holder over water was only 6 per cent. of that obtained under corresponding conditions with freshly prepared gas, although the color spectrum was approximately the same. In other words, acetylene gas will not keep its illuminating power. Moreover, the illuminating power of this gas is shown to vary with the manner in which the gas is obtained from the same materials of calcium carbide and water. The gas obtained by the "dry process" had only about 80 per cent. of the illuminating power of gas obtained by the "wet process." This shows that if water is added to calcium carbide the effective result is not the same as when calcium carbide is added to water.

IMPROVEMENTS IN THE COLOR OF THE ARC.

MANY attempts have been made to improve the violet-blue color of the arc light, which is objected to as much as ever, and, if possible, at the same time to increase the light capacity of the lamp. According to a paper read by W. Wedding before the Union of German Electricians, held this year at Kiel, a considerable amount of success has after all been achieved by H. Bremer, of Neheim, on the Ruhr river, says Engineering. The carbons, that is, only the upper electrodes, are impregnated with salts of calcium, silicon and magnesia, up to 50 per cent. of such salts being added to the carbon. Calcium appears to be the chief ingredient. The reddish yellow flame of calcium softens the tone of the light, which the inventor claims can be varied at will. The calcium oxide coats the inside of the globe, and of the chimney which is used in some lamps, with a white deposit, which helps to diffuse the light in all directions ; so that we do not see a glaring point, with unsteady, ugly shadow lines on the upper half of the globe and a zone of comparative darkness directly under the lamp, but a pretty uniformly bright globe.

The photometer tests which form the chief part of Wedding's paper, illustrate these and other features. With an arc lamp taking 12.3 amperes at 44.5 volts, Wedding observed that the light intensity was almost constant ; over 6,000 candles, in the cone between 45 degrees and 90 degrees with the horizontal, and that on the horizontal itself the intensity was still 1,000 candles. The hemispherical intensity was 4,320 candles, which corresponds to a mean current consumption of 0.126 watt per candle. This a very remarkably low value. The lamp was without a globe ; with a globe the current consumption was 0.196 watt. The carbons are vertically arranged, not quite in alignment. The mechanism is said to be much simplified, but no real information was offered on this point, beyond stating the fact that the arc is considerably flattened out and contributes materially to the light emission. The yellow nature of the light should assist these lamps in penetrating through mists. Some preliminary experiments support this view, but the subject requires further investigation. As regards searchlights and light-house lamps, where this penetrating power would be of paramount importance, the large arc may prove awkward ; for these lamps we want a fairly punctiform source of light. A Bremer arc lamp with four arcs has been suspended at a height of 95 metres (312 feet) from the Eiffel Tower in the Paris Exhibition. The four acres were arranged in two series, and took together 55.8 amperes at 89.3 volts. Tested without a globe, when suspended 8 metres (26 feet) above the ground, light intensities of 80,000 candles resulted, the mean current consumption being 0.1 watt per candle, based upon a hemispherical intensity of 49,730 candles ; the maximum light intensity was observed under an angle with the horizontal of 37 degrees. Fitted with a globe, the hemispherical intensity was 26,890 candles, corresponding to a current consumption of 0.17 watt. The metallic vapors in the arc diminished the resistance of the arc, but the carbons burn away twice as rapidly as ordinary carbons. If, however, the ratio of the carbon section, new to old, is 1.3, as is asserted, that disadvantage would balance itself. No vapors are supposed to escape from the globe. Bremer uses his carbons also with alternating-current arc lamps.

A DETERMINATION OF THE MECHANICAL EQUIVALENT OF HEAT.*

BY DR. HOWARD TURNER BARNES.*

The method employed is that proposed three years ago by Prof. Callendar and the author at the British Association meeting at Toronto. In essence it consists in warming by a steady, measured supply of electrical energy, the volume of water passing at a constant determinate rate through a short small-bore glass tube containing the current-conveying wire. The small-bore tube connects two larger tubes in which are fixed the two members of a pair of differential platinum thermometers. These thermometers are used, when everything has become steady, to measure the difference between the temperatures of the water entering and leaving the middle small tube.

A glass vacuum jacket, itself surrounded by a copper jacket containing water at the inflow temperature, embraces this middle tube ; and thus the heat lost by radiation from the water as it is warmed in and flows from the tube is reduced to a small yet measurable amount. Errors in the final results arising from this loss of heat by radiation, from the loss of heat by conduction, from the tendency of the water to follow unvarying streamlines, and from the thermal capacity of the apparatus, with others of smaller import, were all estimated and allowed for. The most important of the measurements involved are the electrical ; and the accuracy of these depends ultimately upon the accuracy of an international standard resistance and upon that of the voltage assigned to a Clark cell. The Clark cells employed in the present series of experiments gave values agreeing with all the best results obtained in setting up this electro-chemical combination.

The results of the experiments, which extended over a year, are given in 55 tables. From these the author constructs another table of the values of the specific heat of water at temperatures between 0°C. and 100°C. differing by 5°C. In terms of a thermal unit at 16°C. the specific heat at 5°C. is 1·00530, at 40°C. is 0·99735, and at 95°C. is 1·00370. It is a minimum at 37·5°C. In terms of the thermal unit at 16°C. the mechanical equivalent is 4·18876 joules—about 0·132 per cent. higher than that obtained by Reynolds and Moorby in their direct mechanical method. This discrepancy is due, the author concludes, to the fact that the E.M.F. of this standard Clark cell should be taken as 1·43325 int. volts, and not as 1·43420 volts, as used in his calculations. With this new value for the E.M.F. of the Clark cell, the author's results come into most excellent accord with those obtained by Prof. Rowland. The author, however, ascribes the slight differences still existing between his results and the results obtained by the electrical methods of Griffiths and of Schuster and Gannon to the radical difference in the methods of calorimetry.

Engineers are much more willing to help each other than they were twenty years ago. Much of the credit for this desirable state of affairs is due to the engineer's associations that may be found in nearly every state in the Union. This is a move all along the line in the right direction, for the more we help our brother engineers the better posted we become, for a principle that was laid down several hundred years ago tells us that when we improve our talents they will multiply.

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* Abstract of a paper, "On the Capacity for Heat and Water between the Freezing and Boiling Points, together with a Determination of the Mechanical Equivalent of Heat in Terms of the International Electrical Units," read before the Royal Society, being an account of experiments by the continuous flow method of calorimetry performed in the Macdonald Physical Laboratory of McGill University, Montreal.

SPARKS.

The town of Lunenburg, N. S., has been granted permission by the Legislature to borrow money for electric lighting purposes.

A syndicate is negoitating for the purchase of the property and franchise of the Sydney Gas and Electric Company, of Sydney, N. S.

Voting on the by-law to provide $7,000 for installing an electric plant for lighting the streets of Thessalon, Ont., takes place on the 17th inst.

The new lighting company which has been formed in Montreal will be known as the Montreal Light, Heat & Power Company. Mr. H. S. Holt has been elected president, Mr. Jas. Ross first vice-president, Mr. Rudolphe Forget second vice-president, and Mr. H. H. Henshaw secretary. The new company absorbs the Montreal Gas Company, Royal Electric Company, and Chambly Manufacturing Company, and has a capital of $17,000,000. Four of the directors are also directors of the Montreal Street Railway Company.

The power at the head of Shiek's Island dam at Cornwall, Ont., is being developed by Mr. H. P. Davis, from plans prepared by T. Pringle & Son, of Montreal. The power is to be utilized for operating the canal locks. It is understood that the Bullock Electric Manufacturing Company, of Cincinnati, Ohio, have secured the contract for the building of the first of four three-phase generators to be installed. In our next issue we hope to publish a description of the proposed development.

At a recent discussion in the Ontario Legislature on the bill introduced by Mr. Carscallen, of Hamilton, for the protection of life and property in the use of stationery boilers and engines, and the examination and licensing of persons in charge of them, Mr. Whitney, leader of the Opposition, objected to the bill because hardship would result in compelling every person who had charge of such machinery to take a course of study which would entitle him to a certificate; that the owners of many saw-mills and factories could not afford to employ a certificated engineer.

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OPERATING DYNAMOS

That there are more **Victor Turbines** in use supplying power for electric generators than any other, is due to the many points of superiority possessed by this Turbine.



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RECENT PLANTS INSTALLED: Lachine Rapids Hydraulic & Land Co., Montreal, Que., 12,000 h.p.; Chambly Manufacturing Co., Montreal, Que., 20,000 h.p.; West Kootenay Power & Light Co., Rossland, B.C., 3,000 h.p.; Dolgeville Electric Light & Power Co., Dolgeville, N.Y.; Honk Falls Power Co., Ellenville, N.Y.; Hudson River Power Transmission Co., Mechanicsville, N.Y.; Quebec Railway, Light & Power Co., Quebec, 4,000 h.p.; The Ottawa Electric Co., Ottawa, Ont., 2,000 h.p.

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Soon as possible, thoroughly competent Superintendent to take complete charge of the construction department of a Montreal electrical establishment. Must understand indoor wiring in all its branches (Cleat, Moulding, Skeleton-Concealed, and Iron Conduit), and be able to take off quantities from architects' plans for estimates.

A knowledge also of Annunciator and Bell Work will receive extra attention when engaging.

Address in confidence, stating references, salary expected, &c., "Wiring Superintendent," care CANADIAN ELECTRICAL NEWS.

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Lubricating Oils and Greases
Leather and Rubber Belts
Magnolia Metal
Best Anti-friction Metal in World

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Circulates in Every Province.

NATIONAL ELECTRIC LIGHT ASSOCIATION.

The annual convention of the National Electric Light Association of the United States will be held at Niagara Falls, N.Y., on May 21, 22 and 23. On account of its situation in close proximity to the Pan-American Exposition, a most successful meeting is expected.

SPARKS.

The Bell Telephone Company are building on Hayden street a new exchange for Yorkville, North Toronto, which they expect to have completed about midsummer.

Mr. John Ward, formerly manager of the Greenwood branch of the Vernon & Nelson Telephone Company, has been appointed manager of the Kootenay Lake Telephone Company at Nelson, B. C.

Mr. J. K. Dunstan, local manager of the Bell Telephone Company at Toronto, states that there is probably a larger proportion of telephone wires underground in Toronto than in any other city in the world. About half the system is now underground.

Mr. E. F. Clarke, M.P., has given notice in the Dominion Parliament of a bill to compel the Bell Telephone Company to furnish telephones on application to any premises fronting upon or adjacent to any highway on which the company has constructed one of its branches. Another clause provides that after the 9th of July, 1902, no higher rates than those in force on that date shall be charged by the company.

The annual meeting of the Robb Engineering Company, of Amherst, N.S., was held a fortnight ago, when Mr. D. W. Robb was elected managing director. A half-yearly dividend of fou per cent. was declared, and a considerable sum set aside for depreciation and a reserve fund. It was shown that the sales for the year 1900 were about $50,000 above the previous year, while the outlook for 1901 was still brighter, orders being booked for nearly three months' work in advance. During the year it is the intention to extend their buildings and plant.

There is no more reason why an advertiser should stick to antiquated methods than there is why he should insist upon serving his customers with goods which were in style half a century ago. And, furthermore, the merchant or manufacturer who persistently refuses to make his advertising conform to methods which prevail to-day will sooner or later meet the fate which would be his if he refused to keep his stock up-to-date or make whatever commodities he manufactures comply with the requirements of the day instead of those of years ago.—Current Advertising.

ELECTRICAL REPAIRS

In the large and well equipped factories where the manufacture of electrical apparatus is carried out under the piece work system, they find that repair work or apparatus sent in to be repaired or rewound interferes with this system, and in many cases they would prefer not to do this kind of work, as it is almost impossible to do it with dispatch and at a reasonable price. Knowing the above to be a fact,

MESSRS. FRED. THOMSON & CO.
774 Craig Street, MONTREAL, P.Q.

have arranged their works for repair work only. They keep armatures of nearly all makes of dynamos in stock, which they loan while repairs are being made. Their factory is so arranged that they can run night and day, and work can be finished in the shortest possible time. **Telephone Main 3149.**

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Canadian Patent applied for. Any Base, Candle Power, or Efficiency. Sample orders solicited and the most thorough test invited. Every Lamp tested and warranted. Packed 1 dozen in a box, 240 Lamps in a case.

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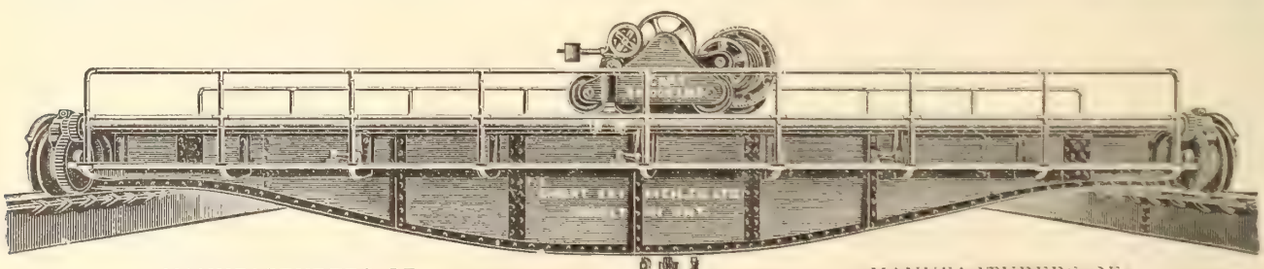
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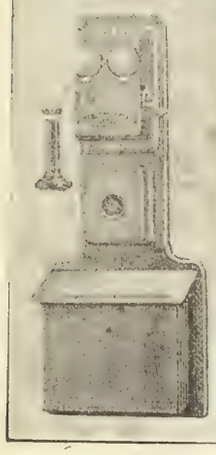
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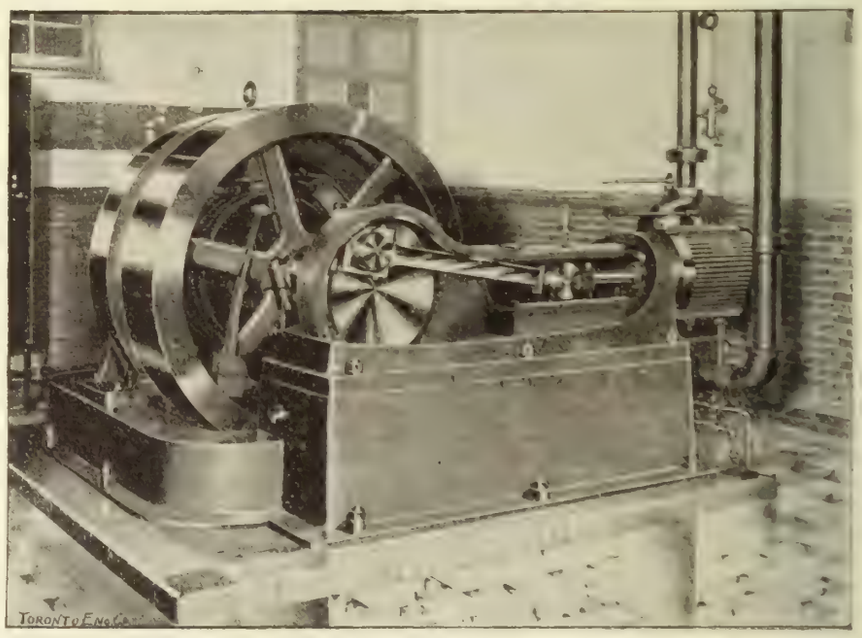
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SPARKS.

The city of Winnipeg is about to enlarge the civic electric light station.

The ratepayers of Amherstburg, Ont., are considering the purchase of an incandescent electric light plant.

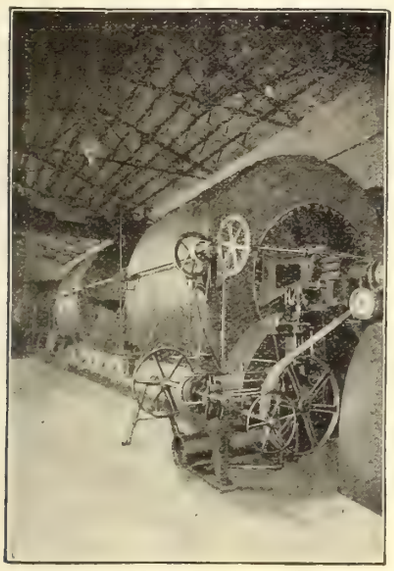
The ratepayers of Midland, Ont., have voted in favor of operating the electric light plant under municipal control.

It is announced that the General Electric Company has been awarded a contract by the Manhattan Elevated Railroad Company, of New York, representing a consideration of $3,000,000. The largest item in the contract is 1,600 motors.

The Canadian General Electric Company is building a new power house at Nassau, near Peterborough. The work is in charge of Mr. Henry Holgate, C. E.

It is understood that the battery plant installed by Mr. W.E.H. Massey at his Dentonia Park farm, for light and power purposes, was not found satisfactory, and has been taken out.

Messrs. Code & Burritt, barristers, have written to the city council of Ottawa asking whether the council would be willing to grant a franchise to the People's Electric Light & Power Company about to be formed, on the same terms as that given to the Consumers' Electric Light Company.



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ELECTRIC RAILWAY STATISTICS.

From returns received from the thirty-five electric railways of Canada, Mr. Geo. Johnson, the Dominion statistician, makes up the following statement :

At the end of December, 1900, the number of miles of electric railway in Canada increased to 681 miles, or 49 miles over the number in 1899.

The thirty-five electric railways in Canada carried 118,129,862 passengers in 1900, an increase of 14,097,-203. This is equal to carrying every man, woman and child in the country twenty-one times. The car mileage run was 30,924,355 miles, an increase of 1,277,508 miles over 1899. The mileage run and the passengers carried show that for each mile run the electrics carried 3.8 passengers, against 3.5 in 1899.

The amount of paid up capital invested in electrics on 31st December, 1900, was $20,633,000, and the bonded debt was $12,619,422.

The number of cars in active service in 1900 was 1,642, an increase of 98 over the previous year. The employees numbered 4,493, showing an increase of 164 over 1899. The total receipts for the year were $5,-422,540 and the expenses $3,268,001.

The steam railways carried 17,122,193 passengers in 1900, so that the total passengers transported by rail was 135,252,055. Between them the steam and electric railways carried the whole population of Canada 25 times in the year, and the proportion was a little over 87 by electric and a little under 13 by steam in every hundred persons carried.

Since 1897 the number of passengers carried by the electric railways increased from 83,811,000 to 118,130,-000, an increase of 34,319,000, which is equal to 41 per cent., while those carried by steam-using rail-ways increased from 13,742,454 to 17,122,193, an increase of 25 per cent. The expenses form about 67.50 per cent. of the gross earnings of the steam-using railways and about 60.27 per cent. of the gross earnings of the electric railway.

The telephone service in Winnipeg was recently tied up for a couple of hours, due to a strike of the operators

The Independent Telephone Association of the United States will hold its next convention in Buffalo on June 11, 12 and 13.

Mr. E. H. Gladwin, local manager of the telephone exchange at Truro, N.S., has recently returned from a trip to British Columbia.

The Bell Telephone Company have recently made some changes in connection with their system in Toronto. Owing to the large number of instruments in use, annoyance has resulted in the central office in making connections. To obviate this difficulty the city has been divided into three sections, known as "Main," "Park," and North," which are prefixed to the telephone numbers. The numbers on the Main section run from 1 to 4,466; those on the North section from 1 to 2,125; and those on the Park section from 1 to 865.

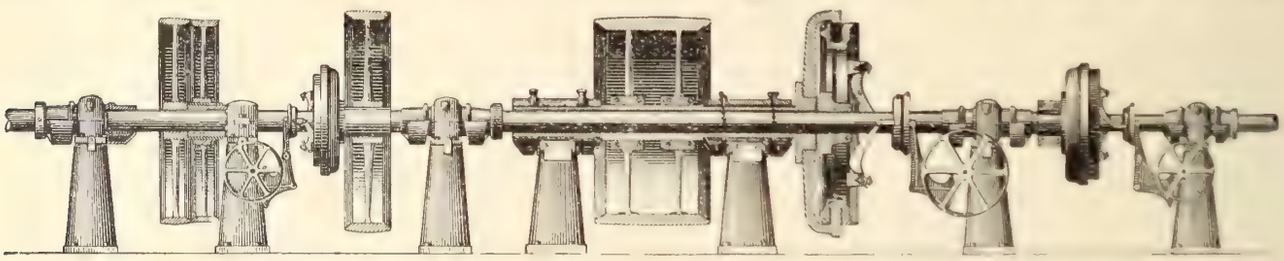
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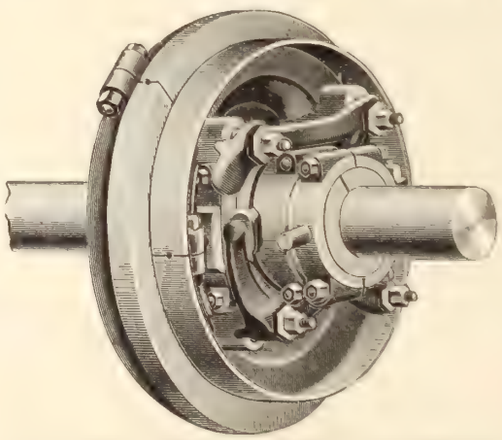
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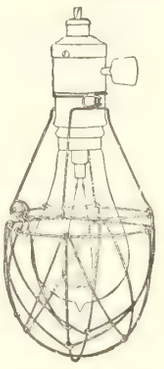


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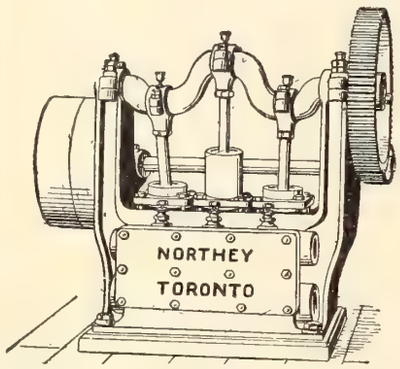
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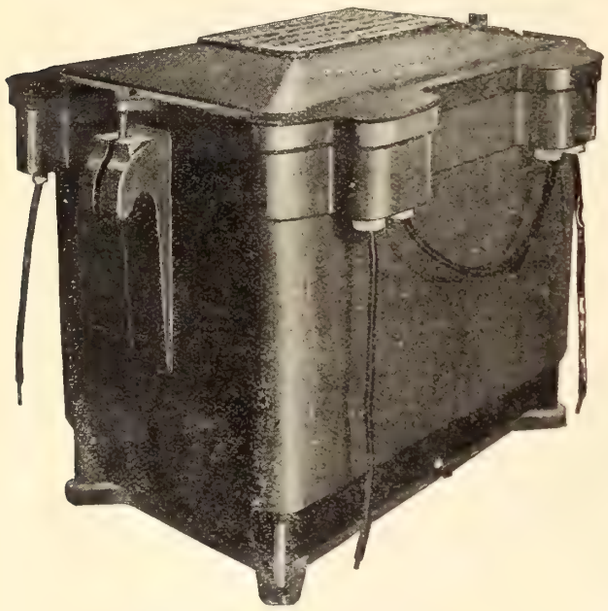


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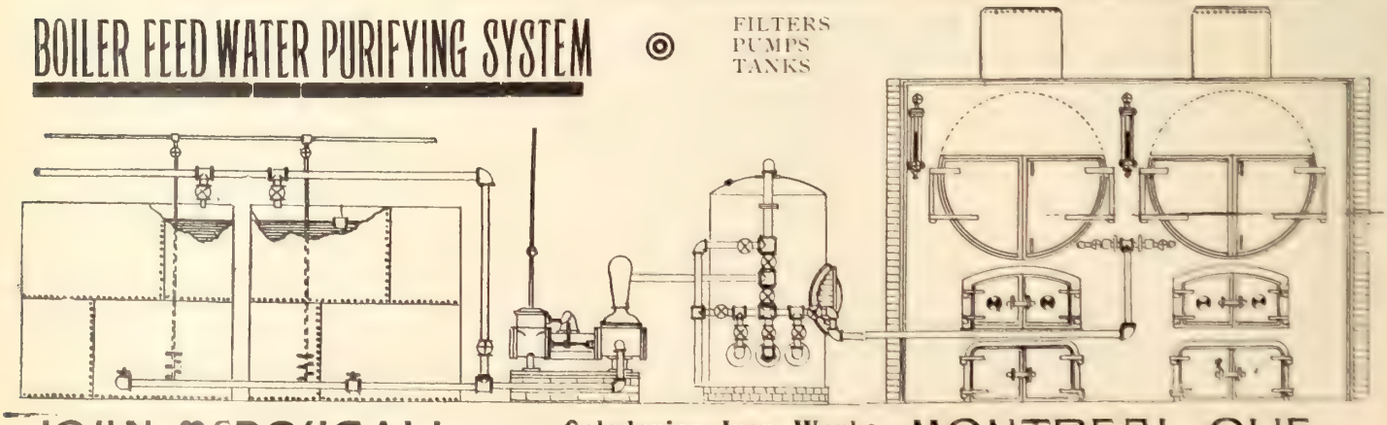
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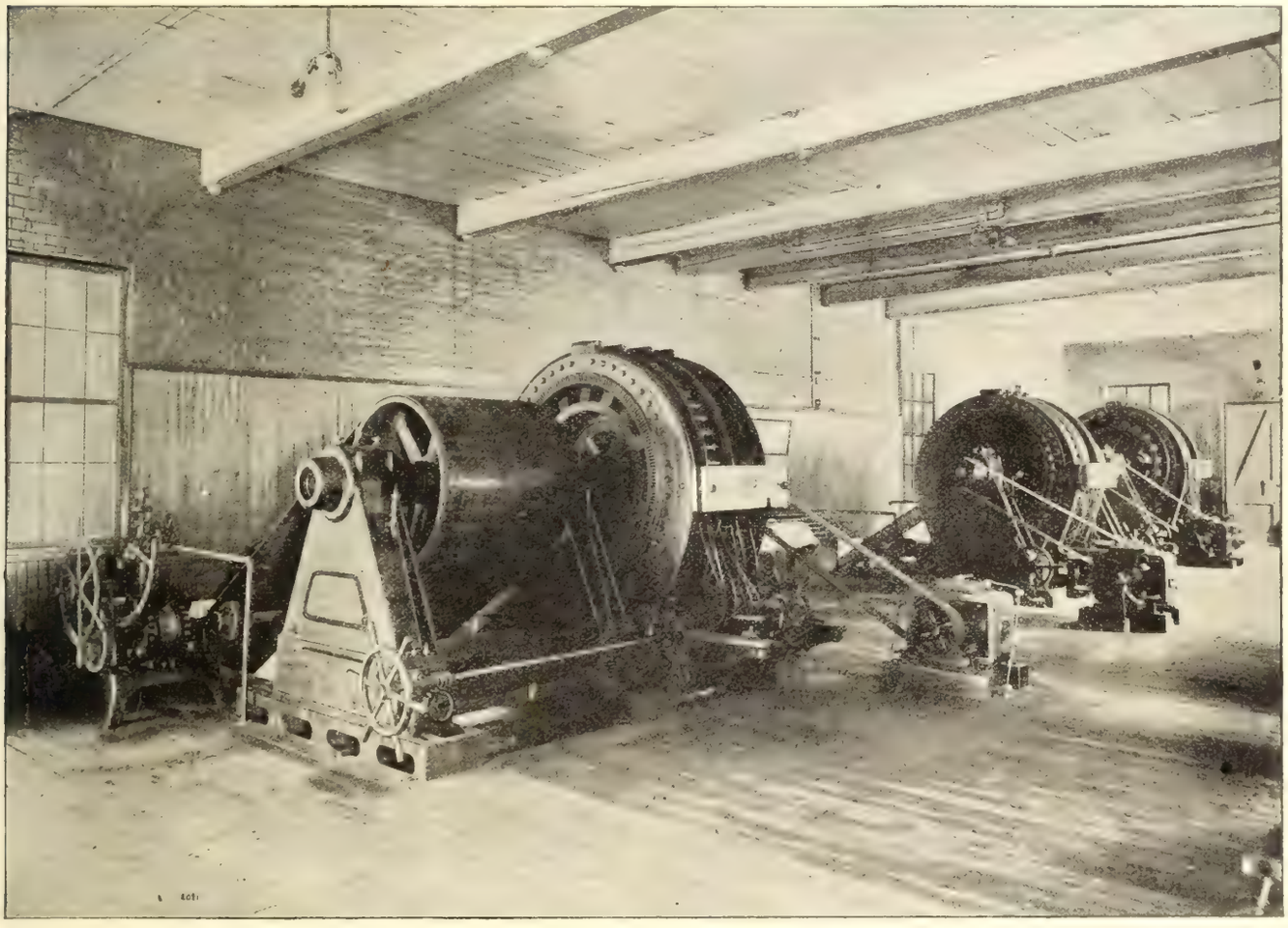
VOL. XI. MAY, 1901 No. 5.

A MODERN LIGHTING AND POWER PLANT.

ONE of the most modern and well cared for electric plants in the country is that operating in the city of Sherbrooke, province of Quebec. Twelve years ago the Sherbrooke Gas & Water Company started to light the streets, using for that purpose two Ball arc dynamos having a capacity of 35 lights each, supplying current for 52 arc lamps of 2,000 candle power. During the same year a 500 light T.H. Royal alternator was installed in order to supply incandescent lamps.

From this modest beginning has developed the present plant, having a capacity of 840 kilowatts. The phenomenal success of this plant has been due in large measure, to the able engineering of its superintendent, Mr. A. Sangster, to a broad policy of dealing with customers, and keeping the equipment always up-to-date.

The power-house is substantially built of brick, and and is situated on a rocky island in the Magog river near the center of the city. Here the natural fall of the river has been utilized to the utmost, and a magnificent water power developed having a working head of 33 feet. The dam is largely composed of the natural bed rock supplemented by massive crib-work where necessary. The construction of the head-race is such that this plant has never suffered any inconvenience from frazil or anchor ice, the bane of most water-wheel plants in this section of the country.



INTERIOR OF GENERATING STATION, SHERBROOKE GAS, WATER & ELECTRIC COMPANY.

The location of power house and dam allows of strong, short steel flumes being used, one for each wheel. The hydraulic equipment consists of three units, each belted direct to a two-phase S.K.C. alternator, having an aggregate capacity of 1,000 horse-power. The wheels are supplied with governors of the Ripogle type, made by Wm. Kennedy & Sons, of Owen Sound, and have proved very satisfactory. There are two 40 inch Crocker horizontal turbines supplied by the Jenckes Machine Company, of Sherbrooke, and one 54 inch New American made by Wm. Kennedy & Sons. Each

is supplied with a pulley carrying a 38 inch belt driving the generators on the floor above.

The generators are of the well known S.K.C. type, as manufactured by the Canadian General Electric Company, Toronto. Generating two-phase current of 133 periods frequency at 2,400 volts. One is of 360 kilowatt capacity, the other two are each of 240 Kilowatts capacity.

Each generator has belted to it a multi-polar exciter, each capable of supplying sufficient current to excite all of the generators.

A handsome marble switchboard extends across the end of the power house, supplied with S. K. C. switches and instruments, as manufactured by the Canadian General Electric Company. The switchboard is supplied with independent phase regulators for each generator, and connections are so made that any of the generators may be operated in parallel or on separate circuits, as desired. To the left of the main switchboard is situated the board for the series alternating enclosed arc lamp system now used for lighting the streets. This system, which has met with such phenomenal success in both the United States and Canada, was installed about two years ago by the Canadian General Electric Company, and consists of two fifty light circuits, each supplied with an automatic regulating transformer. Although severely tested, this system has proved satisfactory in every way. At times it has been found necessary to cut off 14 lamps from one circuit, and the regulation is so perfect that no difference is noticeable on the remaining lamps or on the incandescent circuits which operate in parallel.

The citizens of Sherbrooke have shown their appreciation of good electric service not only in the liberal use of lights, but also of electric current for power purposes, as there are now installed 23 S.K.C. two-phase motors ranging from one to 30 horse power capacity and aggregating a total of 240 horse power. The motors are all of the S.K.C. design and are supplied with condensers. Practically all of the current consumed is measured by Stanley watt-meters, there being upwards of 300 installed.

The neighboring town of Lennoxville, distant seven miles, is also snpplied with light and power from this system. Although the service rendered by this plant is extremely varied, and the motive power is water, yet such great care has been taken to obtain and maintain efficient regulating apparatus for wheels, generators, motors and arc lamps, that the operation of the system is practically automatic and no fluctuations of voltage are noticed even at noon, when motors are stopped and the lighting load is small.

The superintendent, Mr. A. Sangster, has a snug office at the power house, where is also fitted up a small repair shop and stock room for wiring supplies and handling of the arc lamps.

The head office of the company is situated in the Art Building, in the centre of the city; it is presided over by Mr. R. S. Robins, the genial secretary-treasurer, who is always glad to see visitors and talk over the accountant's end of the business, while many pointers on operating can be obtained from the long and varied experience of our friend, Mr. Sangster.

Taken as a whole, this plant is a striking example of what can be done in developing an efficient multi-phase electric distribution from small beginnings, where good sound business methods are followed.



Pan-American Exhibition—Electricity Building.

STEAM ECONOMY.

The American Machinist of March 7 has an interesting article regarding the use of saw dust mortar as a covering for steam pipes. A pipe of 6 to 8 inches diameter was boxed in a wooden box of 12 inches diameter, which was filled with saw dust mortar, one barrel of lime to five of saw dust. Before covering the pipe, nearly 700 feet in length, it condensed 1,440 pounds of water hourly; after covering it condensed 195 pounds hourly. This may serve as a hint to some of our saw mill friends that saw dust is even better to use in saving steam than in making it.

The Bell Telephone Company have just taken tenders for the erection of a new exchange in St. John, N.B., to be of stone and brick. Mr. F. P. Thompson is local manager.

QUESTIONS AND ANSWERS

"R. T." writes: I cannot understand the way in which a compound alternator, which has a commutator, is wound. Would you be kind enough to give me a little explanation?

ANS.—There are two separate and distinct windings on the field of the alternator, one, usually called the separately excited field, being supplied by direct current from the exciter, and in which the current is practically constant, irrespective of the load, analagous with the shunt field of a direct current machine; the other, called the series winding, being supplied with direct current from the commutator of the alternator, this current, and therefore the field magnetism produced by it, rising and falling in direct proportion to the load. The commutator of the alternator, which is exactly the same in its action as that on a direct current machine, is supplied with alternating current either by putting it in series with the armature winding, and therefore the line which the alternator supplies, or else by putting a current transformer in series with the armature and line, the alternating current produced by its secondary, which will be proportional to the primary current or load of the alternator, being commutated and sent through the series field instead of the primary current.

"Student," Montreal: Would you please give me the formula by which to calculate the power necessary to drive a street car or pull a train of cars?

ANS.—The simplest formula is the following, viz.:

$$\text{Horse power} = \frac{\text{Tractive effort in pounds} \times \text{speed in miles per hour}}{375}$$

The tractive effort varies from 15 to 30 pounds per ton, depending on the state of the rolling stock and the rail; it is practically constant for all speeds up to, say, 30 miles per hour.

"Electrician": I cannot get any information on the Mershon compensating voltmeter, and as I have been told that it will compensate for any line loss without compounding my generators, I would be glad of any advice you can give me on the subject.

ANS.—You are apparently laboring under a mistaken impression regarding the instrument which you speak of, which is very general, but nevertheless quite erroneous. It is not a compensating voltmeter, in that it will change the generator voltage to correspond with the load changes, and thus keep the receiving pressure constant, after the manner of a compound wound alternator; but it is a meter which gives the true reading at the receiving or load end of the line, irrespective of the power factor and amount of the load, this result being accomplished through the use of an instrument called by its makers a compensator, and containing a potential transformer, a resistance and a reactance, all being so connected with each other and the meter that the resultant E.M.F. on the latter is proportional to the generator pressure, the reactance E. M. F. and the resistance E. M. F. As the resultant of these three voltages is the voltage at the receiving end of the line, it follows that an instrument actuated by their proportionals will give a true indication of this voltage, taking into account the power factor of the load, which affects the reactance drop to a greater or less extent as it recedes from or approaches unity, and the resistance drop, which varies directly with the load.

"Engineer": I am laying out a new system of piping for my engine and boiler room, and want to move my pump, which sometimes gives trouble when the feed water gets hot. I have been told that it should be piped so as to have the heater between it and the boiler; is this right?

ANS.—Any and all pumps should if possible be located so that the supply of water or other liquids which they may be handling flows to them by gravity. Especially is this true of pumps required to handle hot water, because if they are required to lift by suction their incoming supply, the vacuum which this suction tends to produce will often reduce the pressure of the water to a point which will allow the latter to steam, even though its temperature be considerably below the boiling point at atmospheric pressure. As soon as the steam is formed it breaks the vacuum, and the pump, relieved suddenly of its load, starts to jump. The remedy for this trouble is to change your piping so that the heater will be between the pump and the boiler, and in addition supplying the former if possible by water which flows into it by gravity.

"R. Wilson," Hamilton: I am trying to make an oil tight joint in a tank and want to get a composition which will expand on cooling; can you give me the formula?

ANS.—You will probably find that the following will give you good results, viz.: Lead 9 parts, Antimony 2 parts, Bismuth 1 part, all proportions by weight.

"F. T. W.," Dartmouth, N.S., writes: (a) When tendering for wiring contracts how much work is it usual to estimate for one man per day for cleat work and concealed work? (b) Are the American Underwriters' rules for wiring, which were published in the CANADIAN ELECTRICAL NEWS a short time ago, the same as the Canadian rules in use to-day? (c) In the above rules it was stated that No. 14 B. & S. guage to be the smallest wire allowable for inside work. I have seen smaller wires used since that time.

ANS.—This varies very much, running about 10 to 15 lights per man for 10 hours work on open cleat wiring and from 5 to 15 for concealed work, depending very much on the number of lights per outlet. (b) The Canadian Board of Fire Underwriters have adopted complete the National (U.S.) rules, and therefore all work done in buildings whose insurance is carried by a company which belongs to the Canadian Board must be made to comply with the National Code, which is the one obtaining generally throughout the States. (c) No. 14 is the smallest conductor allowed by the above rules except for fixture and pendant wiring, in both of which cases as small as 18 is allowed, though for the latter work it must be stranded.

Hopkins "Telephone Lines and Their Properties," a work already well known to those identified with telephony, has been revised and enlarged as the sixth edition. Several chapters have been almost entirely re-written, many diagrams added, and the number of half-tone illustrations largely increased. An account of the latest developments in the design of long lines and a short chapter on composite working and wireless telephony, have been added. The book is one which commends itself to the fraternity. Publishers: Longmons, Green & Company, 93 Fifth Avenue, New York; price $1.50.

TURBINE BUILDING IN SWITZERLAND.

Prof. Franz Prazil, of the Federal Polytechnic Institute in Zurich, contributes an interesting and instructive article to the Engineering Magazine under the heading of "Turbine Building and Turbo-Electric Stations in Switzerland." In that country the manufacture of turbines has developed to a marked degree, and is now carried on by twelve companies, whose machines are sold all over the world. Five of these companies have made turbine building the main branch

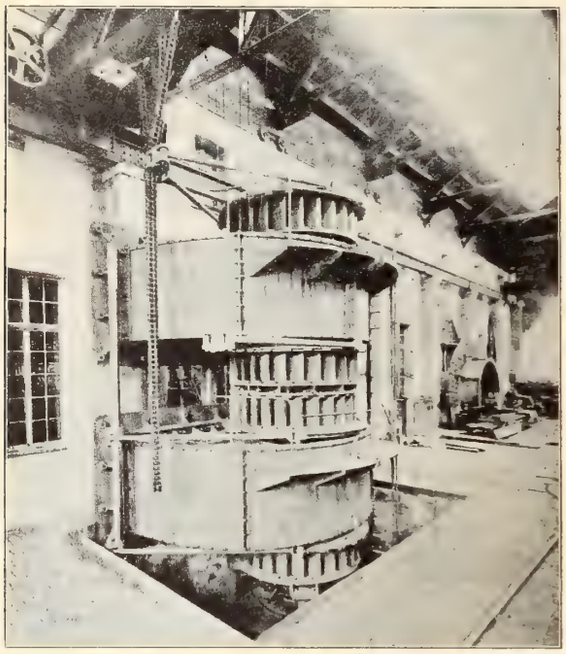


FIG. 1.—A 130 HORSE POWER TURBINE DESIGNED FOR THE ELECTRICAL WORKS AT HAGNEK, SWITZERLAND, AS IT APPEARS MOUNTED IN THE SHOPS OF THE THEODORE BELL COMPANY, OF KRIENS.

of their business, and the total production of these five companies from 1844 to the end of 1899 was 5,850 machines, with a total capacity of 638,000 horse power.

In the second half of the eighties the production of turbines began to make a striking though somewhat spasmodic advance. This was the period in which the first large hydro-electric stations were designed and built, thereby making vital a series of problems whose solutions demanded the best efforts of the engineer. Among these problems wete the construction of exactly working automatic governors, and an increase in the number of revolutions with even small heads, so that wheels could be directly coupled to electric generators. The first large hydro-electric stations, which were built in 1889, were the Schaffhausen central station and the power station of the Neuhausen Aluminum Company.

In the Shaffhausen station, two-ring reaction turbines drive the horizontal shafts of the generators through bevel gearing. Each turbine is constructed for a capacity of 300 horse power, with 15 foot head. The turbines of the Aluminum Company, which are directly connected to dynamos, have a novel feature designed to lessen the pressure on the bearings of the vertical shafts. These otherwise nominally constructed reaction turbines, each having a capacity of 600 horse power with 66 foot head, are so arranged in their casings that the water flows through them from below upward, and thus causes an upward pressure in the direction of the axis which counterbalances the downward pressure due to the weight of the various parts. Besides this, as the energy required varies rapidly, there is a quick-acting throttle-valve in the siphon-shaped delivery pipe which satisfies the requirement for prompt regulation.

In 1890 the hydro-electric station at Berne was built. On account of the considerable variations in head, from 11.5 to 6 feet, the three 150 horse power reaction turbines are constructed with three rings, the middle ring having an automatic governor and the other two being regulated by hand.

In 1891 was begun the installation of the Zurich electric station at Letten, the hydraulic plant of which is remarkable in several respects. The dynamos can be driven by two sets of turbines. One set is fed by the main reservoir of the water-works, while the second set, consisting of high pressure turbines, obtains its water from an auxiliary reservoir, which is filled by pumps at the waterworks whenever there is a surplus of power. The 300 horse power high pressure turbines have spoon-shaped buckets and are provided with hydraulic governors. The construction of turbines and governors was not first made in 1891, but this plant gave an opportunity for a series of experiments in regulation which were of importance for the development of such arrangements of water wheels.

In the years 1892 to 1896 a number of great works were undertaken, each one of which showed an advance in hydraulic construction. The turbines of the plant at Interlaken, on the Aar, are double ring reaction turbines with patent aspirators; the Schaad automatic governor was used for the first time with them. The turbines in Olten-Aarburg are three ring reaction turbines of large dimensions, and are characterized by a very thorough equalization of the blade angles in each ring. The employment of a forged shaft, hollow throughout, is also worthy of mention. In these installations we find already a striving towards the most exact regulation possible, as the use of the above named governors led to satisfactory results. But it is undeniable that there was found no adequate solution of the difficulty encountered if high speeds were to be used, although this would have been desirable on account of the comparatively small and very variable heads which

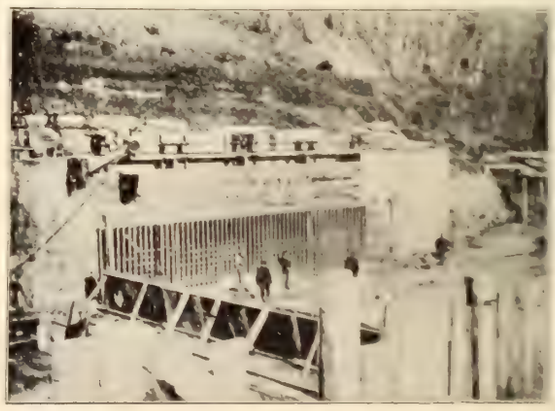


FIG. 2. SLUICE GATE AT ENTRANCE TO HEAD RACE TUNNEL, ZUFIKON-BREMGARTEN ELECTRO HYDRAULIC INSTALLATION.

are characteristic of the conditions of the plants referred to.

During the period from 1892 to 1899, the electric stations at Rathausen, near Luzern, and in Zufikon-Bremgarten, were erected on the Ruess. The hydraulic machinery of the Rathausen installation is of the low pressure type. With a head varying from 13.5 to 15.8 feet, this station has a capacity of from 1,200 to 1,500 horse power, which is converted into electric energy

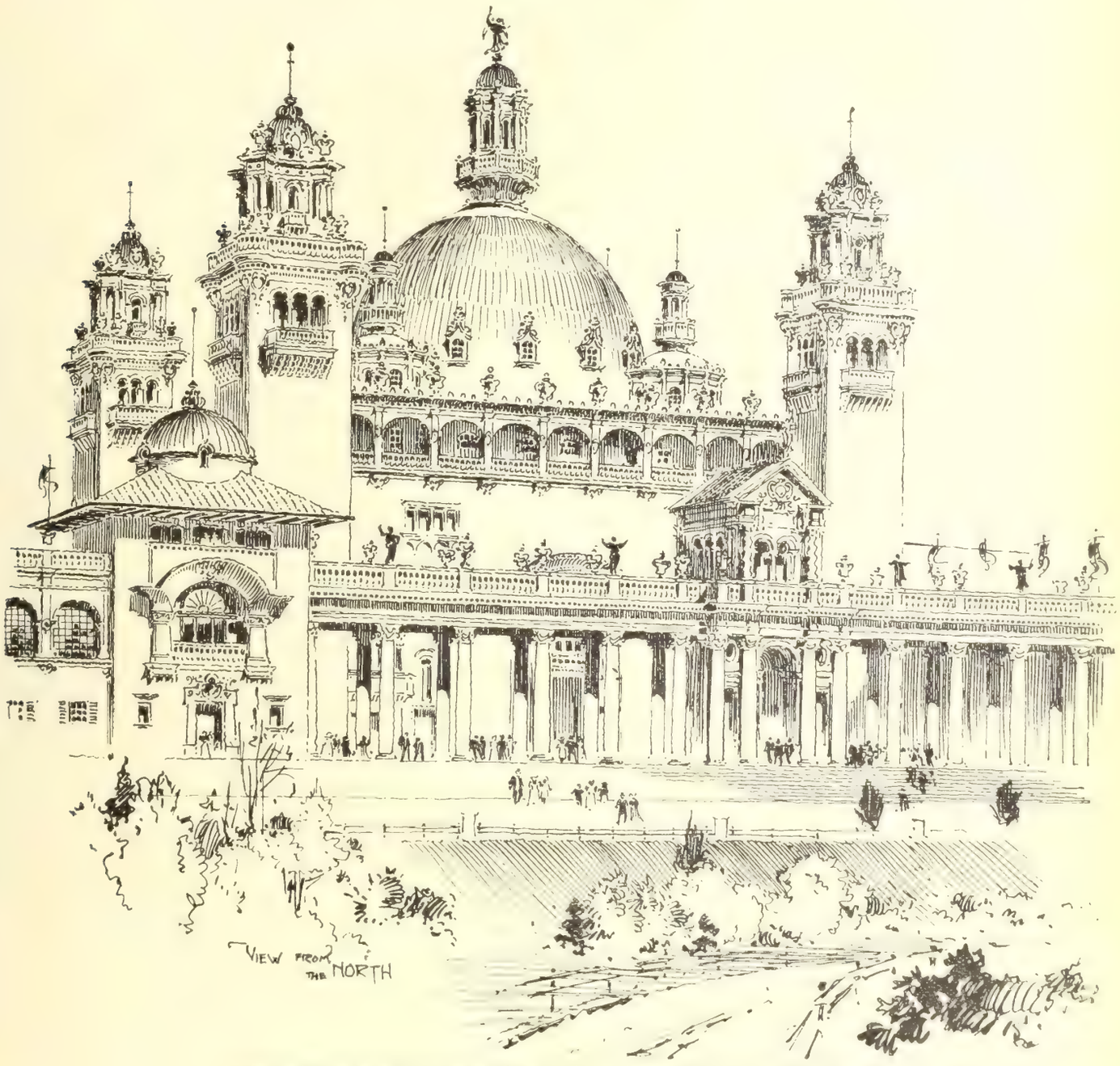
by means of direct-coupled, two-phase generators with a voltage of 3,300, and thus supplies Luzern and the vicinity with power and light.

The plant in Zufikon-Bremgarten is of high interest, because it shows a decisive attempt to increase the number of revolutions. A view of the sluice gate at the entrance to the head-race tunnel is shown in Figure 2. The plant is situated near the town of Bremgarten, where the Ruess makes a bend of nearly 180 degrees. By building a dam 230 feet long at this point, a head of from 16.4 to 21.3 feet was secured, and the water is led through a tunnel 1,150 feet long, the maximum flow being 883 cubic feet per second, directly to the turbine house. In order to secure a higher speed the turbines are double ones in concrete casing. There are four units, each of 325 horse power at 115 revolutions per minute, and each directly coupled to a 5,000 volt polyphase generator.

CANADIAN ELECTRICAL ASSOCIATION.

Reports received from the various committees which have in hand the perfecting of the arrangements for the annual convention of the Association at Ottawa, are most satisfactory.

A splendid list of papers has been secured. Interesting reports will be presented by special committees appointed at last year's meeting to consider certain matters affecting the welfare of the electrical companies. The constitution has been carefully revised, improved in many points, and rendered more workable.



Glasgow Exhibition Buildings—View of Main Building from the North.

The local committee are exerting themselves to the utmost to give visitors to the convention an interesting, enjoyable and profitable time.

The last word received from the capital states that a satisfactory turn-out of the members is now the only requirement for the success of the meeting.

The dates selected for the convention are the 19th, 20th and 21st of June, the most enjoyable season of the year, when most persons are looking forward to an outing. All the conditions are therefore favorable to a large attendance and a successful meeting.

Aluminum Solder.—(1) 1.55 parts tin, 23 zinc, 5 silver, and 2 parts aluminum. (2) 89.5 zinc, 4.5 copper, and 6 parts tin. (3) 94 parts of tin and 6 of bismuth.

An extract is stronger than the original substance. A concentrated campaign in a few good papers is more effective than small space in a great many.—Current Advertising.

Mr. E. W. Holst has resigned his position with the Canadian General Electric Company at Peterborough, Ont.

CANADIAN ELECTRICAL NEWS AND ENGINEERING JOURNAL

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EDITOR'S ANNOUNCEMENTS.

Correspondence is invited upon all topics coming legitimately within the scope of this journal.

The "Canadian Electrical News" has been appointed the official paper of the Canadian Electrical Association.

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Electric Lighting Leads.

THE Committee on Light of the Board of Legislation of Cincinnati recently visited a number of the leading cities of the United States to enquire into street lighting methods. Their report shows that electric lighting, especially by means of enclosed arc lamps, has given the most satisfactory results for business streets. In Boston Welsbach lamps are to some extent being replaced by arc lamps, while in no instance have arc lamps been replaced by Welsbachs.

Electric Railway Consolidation.

THERE is said to be a marked tendency in the United States towards the consolidation of electric railways now operated independently. The prophesy is made that the electric railway lines when thus consolidated will become strong competitors as passenger and freight carriers of the steam roads. Perhaps so, but such has not been the outcome of consolidations in this country. As independent systems the electric railways act as an effectual check on the steam roads as regards their charges for local passenger and light freight service. If amalgamated and operated as a single system, one of two results might be expected to follow, neither of which would benefit the public. Either the electric consolidation would sell out to the steam road consolidation, or a cast iron agreement as to rates would be entered into between the two. As between a situation of that kind and the one now existing, the public would seem to be infinitely better off with things as they are.

The Manhattan Railroad Equipment.

WHEN the changes now under way on the Manhattan elevated railroad of New York city are completed, another example of the advantages of electric traction will have been provided. With a view to adopting the best possible system, the company built a short experimental line on which experiments and tests were made. About a year ago the contract for the electrical equipment of the power house was awarded to the Westinghouse Company. Within the past month a contract has been closed with the General Electric Company for the rolling stock equipment, involving apparatus and supplies approximating $3,000,000, said to be the largest contract ever awarded to an electrical company. It specifies the multiple unit train control, with motors for 800 main cars and half that number of trailers. As each motor car will have two motors, there will be 1,600 motors for these cars alone. A provision of the contract is that the motors shall be delivered within ninety days.

Steel Rail Manufacture in Canada.

APART altogether from the question which has been recently under discussion in the Dominion Parliament regarding the advantages or disadvantages of the terms of agreement made by the Minister of Railways and Canals with the Clergue Syndicate for the manufacture of steel rails at Sault Ste. Marie, Ont., for use on the Intercolonial Railway, it must be gratifying to every Canadian to learn that the manufacture of steel rails is to be commenced in Canada. It is a natural outcome of the rapid development of the iron and steel industry which is now taking place in this country, and we hope that the enterprise may prove successful. Experiment is to be made with the manufacture of a nickel steel rail, which it is believed will prove

very much superior to the ordinary steel rail now in use. Should expectations in this direction be realized, this country would enjoy a very distinct advantage in this line of manufacture, seeing that we have probably he most extensive deposits of nickel in the world.

Exit the Tall Chimney.

Mr. Edward Atkinson, the well known insurance authority, of Boston, recently took part in a public discussion in that city relative to the means which might be adopted to abate the smoke nuisance. He held that the days of the tall factory chimney were numbered, and that the chimney of the future would be a low stack of large area, the draft for which would be supplied by mechanical means. But what substitute shall be found for the tall chimney as an evidence of our prosperity as a manufacturing nation?

Electrical Development in Great Britain.

Electrical development in Great Britain is proceeding at a much faster rate than ever before. This statement specially applies to electric traction, which branch has absorbed nearly half the total investment in electrical undertakings, estimated at £123,000,000. There are 470 miles of electric railways in operation and 500 more in course of construction. In London alone there are in operation 14 miles of underground electric railway and 40 miles under construction, while the future development can be gauged by the fact that seventeen new lines are now being promoted. The great success of the electric street railway at Liverpool has had much to do with the introduction of electric traction in other provincial towns. The establishing of large works in England by the Westinghouse Electric Manufacturing Co. is a practical evidence that in the opinion of that shrewed concern there is to be a large growth in electrical undertakings in the mother country in the near future. The average return on the capital already invested in such undertakings is given as 5½ per cent. which to the British investor will probably be satisfactory.

Niagara Falls Power.

It was announced last week that work had been commenced looking to the development of the power on the Canadian side of Niagara Falls, under the charter held by the Canadian Niagara Power Company. It was even stated that a well known Canadian firm had secured the contract for the electrical apparatus. Although some work was no doubt in progress in the locality of the proposed development, it was not generally believed that the company was about to proceed immediately to construct works, as previous announcements of a similar character had proven groundless. At the time of writing it has been found impossible to confirm the reported award of the contract for electrical machinery, and the intention of the Canadian Niagara Power Company is still in doubt. The agreement with the Canadian Niagara Power Company was first made in 1892. It was revised in the fall of 1899, and under the agreement now existing the company must pay a rental of $1.50 per horse power per year for the first 10,000 horse power developed, $1 per horse power for the next 10,000, 75 cents for the next 10,000, and 50 cents per horse power for all above 30,000 horse power. Since the new agreement, what might be termed an opposition company has been formed, the Ontario Power Company, which proposes to utilize the waters of the Welland river. These companies have no doubt learned with satisfaction of the successful transmission of electric power from the Tuba river to Oakland, California, where it is used for operating the street railway system. In this undertaking the voltage used is 40,000. If it is found profitable to transmit current a distance of one hundred and forty miles in California, the transmission from Niagara Falls to Toronto should offer no obstacles which cannot be overcome. Of course in California coal is much more expensive than in Ontario, thus giving a water power plant there an advantage. Granting that the power can be sold at a reasonable price, there should be no lack of demand. The Toronto Electric Light Company and the Toronto Street Railway Company would doubtless be willing to close down their generating plants if it could be shown that Niagara power could be obtained at a lower cost than that at which it is being produced in their power stations. The Montreal Street Railway Company have made a move in this direction, having contracted with the Chambly Power Company for 5,000 horse power at the price of $25 per horse power per year. The cost of coal is a most important consideration in the operation of steam power plants. At the present time only two United States companies are shipping soft coal to Toronto, and developments on the other side have been such that an amalgamation of these two companies might be expected at any time. The result of this would be to advance the price of coal, thus increasing the cost of producing electric power by steam. Then a more favorable opening for Niagara power in Toronto and other places distant from the Falls would be offered.

Electricity at the Pan-American Exhibition.

The beautiful and interesting decorative displays at the Chicago and Paris exhibitions were made possible by the use of electricity. To this agency was also due the opening of the Exhibitions at night and their perfect illumination. At the Pan-American Exhibition which opened a few days ago in Buffalo, electricity will play a more important part, for decorative and illuminating purposes than ever before. The near proximity of the immense generating stations at Niagara Falls puts at the disposal of the management almost unlimited facilities in this direction. We are told by the official magazine that the number of lights and the quantity of light will exceed that of any other equal area ever artificially illuminated, and it will be evenly distributed; that unusual spectacular effects will be produced by the many combinations of light and water and these combinations are to be so graded as to climax in keeping with the decorative lights at the electric tower; that the electric tower basin will be the stage of the display of a combination of 1,500,000 gallons of water per hour in fountains with the light of 100 large-sized searchlights.

Mr. James Douglas Reid, known to telegraphers throughout the country as the "Father of the Telegraph," died in New York on April 28th. Mr. Reid gained his destinctive title because he was a pioneer in establishing the telegraph and was associated with the inventor, Prof. Morse. Born in Edinburgh in 1819, he moved with his family to Toronto in 1834, becoming junior clerk in a bank. He removed to the United States in 1837 and took a contract for the construction of a telegraph line from Philadelphia to Pittsburg. Later appointments were as superintendent of the Megantic Telegraph Company, Atlantic & Ohio Telegraph Company, and the New York, Albany & Buffalo Telegraph Company. He founded and edited the National Telegraph Review in the early fifties, and in 1877 published his first edition of "The Telegraph in America."

MONTREAL

Branch office of the CANADIAN ELECTRICAL NEWS,
Imperial Building,

MONTREAL, MAY 5TH, 1901.

RULES GOVERNING ELECTRICAL INSTALLATIONS.

In the new building by-law passed by the city council on February 4th, 1901, the clause governing the installation of electric apparatus, etc., for electric light, heat and power reads as follows :

Section 116.—All the electric apparatus, wires, etc., for the generation or supply service in any central station or isolated plant, and all wires, lamps, motors, etc., used for light, power or heat in any public or private building, shall be installed according to and in conformity with the rules and regulations of the Canadian Association of Fire Underwriters, and in order to secure conformity to said rules and regulations, all such installations shall be subject to inspection and issuance of a certificate to that effect from the electrical inspection department of the city of Montreal. In order that proper inspection may be made, due notice shall be given to the building inspection office of any intention to install any such electrical wires or apparatus for the purposes herein mentioned, in order to allow of inspection of the installation as the work progresses, and before any portion of such work is covered or concealed, and no installation shall be considered complete and in conformity with said rules and regulations, until a certificate shall issue from the inspection department to that effect. In all cases, the inspection department shall have power to decide and determine whether such work has been done in a safe and proper manner, and the issuance of a certificate therefor shall be in evidence thereof.

(a) All materials, switches, wire, or any other auxiliary apparatus or device partaining to said installations, shall be subject to the inspection department before being used for such purpose.

(b) All wires of any description, either for telegraph, telephone, electric light, heat or power, on, or entering any building, public or private, shall be subject to the supervision of the inspection department, and with power on the part of said department to compel the placing of those wires in a proper and safe manner.

(c) All theatres and all public halls for scenic display shall be subject to inspection at least once a year.

(d) In case of any installation already in operation, either of generating plant, motors, wires, or other electric apparatus located in any building or premises, becoming defective, to such an extent as to threaten immediate danger to life or property, the inspection department, having notice thereof, shall have immediate power to suspend the operation of such, pending the necessary repairs.

(e) The Inspector and City Electrician shall, at proper hours, have the right to enter any building or premises where electric power or light is being used, to inspect all electrical wires or apparatus, in order to ascertain if the proper regulations have been complied with, and no person shall refuse to allow such inspection.

(f) No alteration or change shall be made in the plan of wiring any building, without notifying the Inspector and securing a permit therefor, and subjecting the plan of wiring to inspection, as herein provided.

MCGILL EXAMINATIONS.

The results of the examinations of McGill University were announced a few days ago. The following students were successful in electrical and mechanical engineering, and are entitled to the degree of B. A. Sc. :

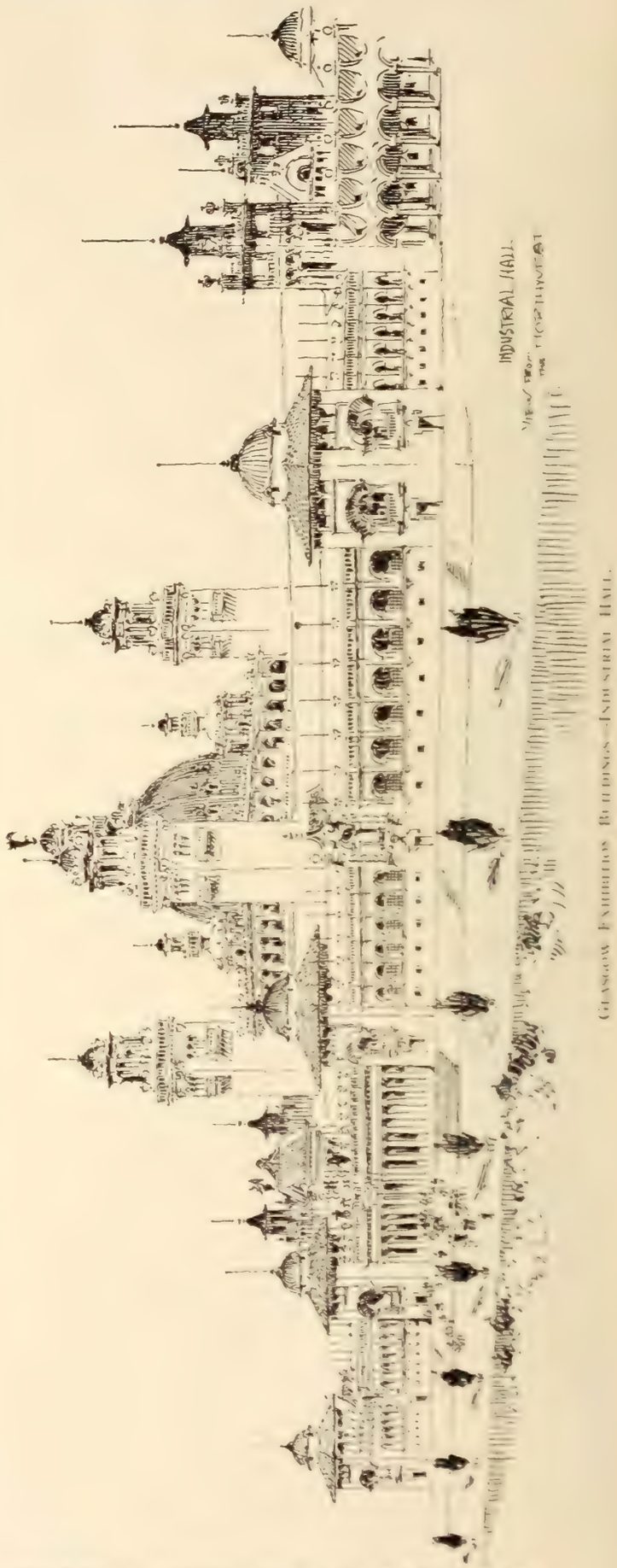
Electrical Engineering—McLaren, J. H.; Burson, H.A.; Glassco, A. P. S.; Taylor, C. W. ; Howard, R. F., and Walker, F. W., B. Sc., equal ; Coussirat, H. A. ; Neville, T. P. J., B. Sc. ; Wenger, E. I., B.A. Sc. ; Sise, P. F. ; Ward, P. W., Lloyd, H. M., Scott, H. M. Mechanical Engineering—Schwitzer, T. H.; Burwall, E. V.; Hampson, E. G.; Cameron, H. D.; Lowden, W. K.; Wilson, R. C.

In the third year the successful students in the electrical and mechanical courses were :

Electrical Engineering—Harry E. Scott, Napanee, Ont. ; Emerson S. Franklin, Wolfville, N. S. ; Philip T. Jackson, Toronto ; Marshall A. Maxwell, St. Stephen, N. B. ; Thomas N. Hicks, Perth ; J. Macd. Smith, Petitcodiac, N. B. ; John C. W. Dunfield, St. John's, Nfld. ; William E. Murphy, Shelburne, N. S. ; Eric J. Mackay, St. Johns, Nfld. Mechanical Engineering—Frank E. Stearns, Merell, P. E. I. ; Gerald M. Smith, St. John's, Que. ; David M. Fry, Bright, Ont. ; Thomas H. Addie, Sherbrooke; Alex. Baird, Sherbrooke ; Emil R. Newton, Drummondville, Que.

The results of the second year in the same branches were as follows :

Electrical Engineering—Alvah E. Foreman, Vancouver ; Roscoe V. Conklin, Winnipeg ; Alex. S. J. Peaslee, Ohio ; Herbert F. Rodger, St. John's, Nfld. ; James F. McDonald, Westville, N. S. ; Franser S. Keith, Smith's Falls ; Harry E. Blatch, St. John's, Nfld. ; Charles L. Trimingham, Barbadoes, W. I. ; C. Percy Cole, Montreal ; Charles W. Stokes, Woodstock ; K. McCaskill, Vankleek Hill ; Wm. H. Sharpe, Montreal ; Hartley M. Pearson, Huntingdon ; Wm. E. Baker, Montreal ; Bertram James, Heart's Content, Nfld. ; Walter R. Brechen, Charlottetown. Mechanical Engineering—Fred. R. Brown, Montreal ; Arthur R. Roberts, Montreal ; Fred. A. McKay, Montreal ; Chas. M. McKergow, Westmount ; Reginald D. J. Denne, Montreal ; John H. Edgar, Montreal.



GLASGOW EXHIBITION BUILDINGS—INDUSTRIAL HALL.

United States consolidations are going it ; the latest on the tapis is a consolidation of interests of the manufacturers of incandescent lamps.

It seems strange that while under the British flag, English fittings of certain kinds cannot be used if a clear certificate is to be had. The English Board of Trade are surely as anxious to safe-

guard fire interests as is the United States National Board of Fire Underwriters, but because we have "swallowed" the United States rules, strictly speaking, no fittings but those of United States manufacture could be accepted.

Montreal contractors are beginning to wonder if we have an alien labor act in Canada, or if it is only an illuminated document to be admired?

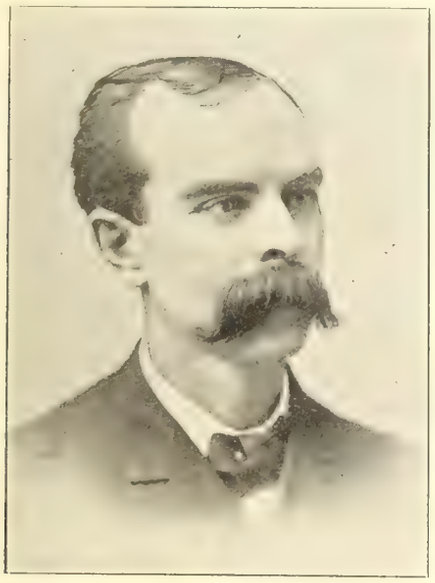
The latest is: One of 'nos compatriotes' in Montreal writes a prominent United States firm as follows:—"I am handling several electric goods as agent, and would like to know if I can have the agency for your goods for Montreal and suburbs, that is Quebec, Ottawa and Toronto!"

The question of grounding the centre of the secondary of transformer is arousing a little interest here. One or two isolated requests have been made by consumers of both Royal and Lachine current to have this done. There is as competent authority against this practice as there is for it, consequently it would be well in a matter of this kind, evolving as it does a radical change, to "make haste slowly" and profit by the experience of others. Should this practice come into vogue, considerable more care will require to be taken by certain manufacturers of transformers.

Mr. H. O. Edwards, who has been favorably known as assistant to Mr. W. H. Brown, the general manager of the Royal Electric Company, has under the new consolidation of interests been moved to the Canadian General Electric Company s quarters in Toronto. Mr. Edwards was for a number of years with the Royal, and is esteemed by all the "old boys" who will miss him here, but who wish him luck in his new sphere.

DEATH OF A CANADIAN ELECTRICAL INVENTOR.

Canadians generally, and the electrical fraternity in particular, have learned with deep regret of the death,



THE LATE JOHN C. HENRY.

at Denver, Colorado, on May 4th, of Mr. John C. Henry, to whom is due in large measure the improved methods and principles of the trolley street railway system now so largely in use throughout the world. Mr. Henry was a pioneer in the electric railway field, the inventor of the principles employed in the first electric railroad ever built in America.

That Mr. Henry was a Canadian by birth is perhaps not generally known. He was a son of Mr. Thomas Henry, of Woodstock, Ont., and spent the early part of his life in that city. He was first employed in Woodstock as a telegraph operator for the Montreal Telegraph Company, and later as night operator at the G. T. R. station. When twenty years of age he went to the United States, and after working as a telegraph operator in Kansas, occupied prominent positions with the General Electric Company, of Schenectady, N. Y., and the Westinghouse Electric Company, of Pittsburg, Pa.

When working as an operator he gave much study to various inventions bearing upon electric traction, and as a result was engaged by a celebrated author and lawyer, the late Judge Henry, to build an electric railway out of the town of Independence, according to certain designs which the young operator had drawn in his spare moments. At that time there were no electric roads. Electric traction, to use Mr. Henry's own words, was about as far advanced as aerial navigation is to-day. The plan of running a wire above the car and establishing contact with it by means of a pole was the product entirely of Mr. Henry's brain. On the road-bed below it was unnecessary to place anything but the rail. So successful did the line to Independence prove that for many years its principal features were followed in electric railway construction everywhere. How little was known throughout the country at that time in regard to electric traction may be judged from the fact that one of the foremost cable engineers in the country assured the president of the Kansas City Railway that it was impossible to run cars with self-contained power up a seven per cent. grade, "because the wheels would slip." Yet in 1886 the East Fifth Street railway in Kansas City was equipped with four motor cars, and after the road was opened several other electric railways planned after it were constructed in California.

The first electric car designed by Mr. Henry is still intact in Kansas City. He used for the motor an old generator in which the current was reversed. It stood in the middle of the car and ran all the time, the car being started and stopped by connecting and disconnecting the axles from the motor. When the first line was built Mr. Henry was assured by a prominent electrical engineer that it would take copper generators as large as his thigh to carry current enough to operate the machinery. To build the trolley wires it was necessary to buy copper rods and solder them together, as no wire was drawn in continuous lengths of the necessary size. The obstructions seemed insuperable, while the experts of the day offered every discouragement. It was only Mr. Henry's confidence that he was right and that the electric railway was a possibility that kept the experiments moving until the trolley was heard all over the country.

Mr. Henry also devised the carbon brush for electric generators, the swinging trolley controlled by a rope, the direct connected motor, and step-up and step-down transformers by which the long distance transmission of power was made possible. Details of the latter invention were, however, worked out by other hands.

When Mr. Henry's failing health compelled his removal to Denver he established a small work-shop, where he worked when his strength permitted upon various inventions and improvements, from some of which, it is said, he recently realized a considerable sum. One month before his death he was engaged on an automobile motor, said to embody new ideas in automobile construction. His brain was most active at night, and through the silent hours he worked out the details of inventions and improvements in one of the most difficult and technical of scientific branches. Mr. Henry's son will, it is understood, carry out the plans of his father as far as is possible.

As is frequently the case with inventors, Mr. Henry apparently did not realize the financial value of his inventions. Had it been otherwise he might have been many times a millionaire.

Mr. Henry was about fifty years of age. The accompanying portrait is reproduced from a photograph taken some time ago.

ELECTRIC HAULAGE SYSTEM FOR SHIPS.

In the February number reference was made to an electric marine railway in operation at Liverpool, Nova Scotia. Herewith we give two views of the plant and some further particulars regarding the installation.

The plant was devised for the purpose of hauling vessels out of and lowering them into the River Mersey, a distance of over 500 ft. on an incline having a grade of half an inch to the foot. Some years ago the Liverpool Marine Railway Company, Limited, had a slip of this kind in operation, whose motive power was horses. A framework carried two horizontal gears attached to which was a beveled gear with a vertical shaft projecting upward, and working on this were two long arms or sweeps. To these were hitched two or four horses travelling around on an upper platform, which was reached by a runway outside the building. The animal power was, of course, limited in its capacity, and extremely slow, it taking three to four hours to haul up a small vessel in the cradle. While the vessel was undergoing repairs, it was held from running back by a great dog in a ratchet. When the work was finished it was the custom to knock out the dog and let the cradle go "by the run" back into the water. It is almost needless to say that this crude method soon wrecked the cradle and the track as well. The result was that the whole plant fell into disuse and decay.

During the past year a new company was organized with the object of rebuilding and equipping the slip in an up-to-date manner, and when it came to the question of the best power it was decided to use an electric motor, there being, moreover, a lighting system in town driven by water power, from which the current could be obtained very cheaply. A Stanley or S. K. C. 30 h. p. induction motor has been installed, which will raise and lower ships of a burden up to 400 tons, over a track which is 600 feet in length, in the remarkably quick time of 25 minutes. The equipment has so far proved a very economical and highly satisfactory investment. The motor is geared to a worm, which in turn operates a further train of gears, as illustrated in Figs. 1 and 2 herewith. On the shaft of the large and last gear is a sprocket which engages an endless two-inch chain that hauls the cradle. The whole thing is as

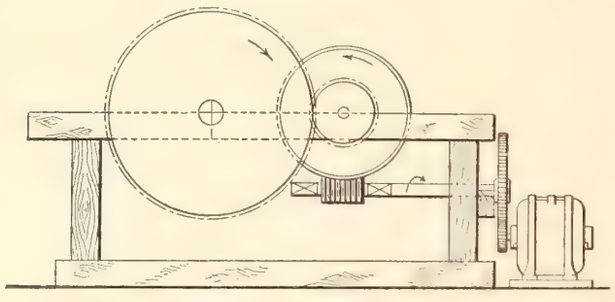


FIG. 1.—LIVERPOOL MARINE HAULAGE SYSTEM.

simple as possible. It will, of course, be understood that the gears and sprockets are within the frame and not outside, and it may be added that the frame is much heavier than shown. It was found feasible to use much of the old gearing. The framework was set on a bed of concrete 3 feet deep and fastened firmly into place by heavy rods running up through the concrete and frames. It also butts against the end of the slip, so that there is not the slightest chance for it to move.

It has been arranged to hold the next annual meeting of the Old Time Telegraphers' Association in the city of Montreal on September 11th, 12th and 13th next.

EXTENSION TO POWER PLANT.

The West Kootenay Power & Light Company, of Rossland, B. C., are about to make a large addition to their power plant at Bonnington Falls. Mr. L. A. Campbell, the general manager, advises us that the contract has been let to the Canadian General Electric Company to install a 3,000 k. w. generator, 180 r.p.m., with three 1,250 k.w. step-up transformers and three 1,250 k.w.

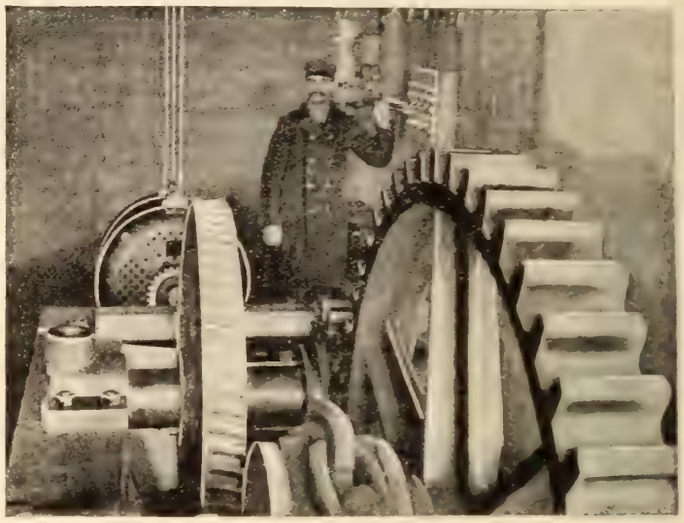


FIG. 2.—INTERIOR OF LIVERPOOL MARINE HAULAGE PLANT.

step-down transformers, and all necessary switch-board apparatus. The water wheel setting will be composed of four 45-inch Victor turbine wheels on one shaft, capable of delivering to the generator coupling 4,800 h.p. under 38 feet head. These wheels will be furnished by the Stillwell-Bierce & Smith-Vaile Company, of Dayton, Ohio. The structural iron work is in the hands of the Jenckes Machine Company, of Sherbrooke, Que. When the new apparatus is in operation it is understood to be the intention to raise the voltage to 30,000 volts. The company are developing hydraulic work for 12,000 h. p., and when the installation of the new 3,000 k. w. unit is completed, they will have an output in their plant of 8,000 h. p., with pen-stocks installed to be increased to 16,000 h. p. This company, it is said, have been negotiating with the C. P. R. for the operation of their road from Trail to Rossland by electricity.

It is announced that the landing site for the Pacific cable in British Columbia has been purchased, and consists of 100 acres of land on Barclay Sound. The place is described as splendidly adapted for the station, from the fact that it is surrounded by perfectly smooth water, is well sheltered, and the bottom of the harbor is such as to furnish good protection for the wire. The site was selected by Mr. R. E. Seake, of the firm of Clark, Forde & Taylor, who is now en route to Brisban, Queensland, to select the landing place there, afterwards proceeding to Sydney, N. S. W., to join the steamship Britannia, which has been sent out to aid him in selecting suitable landing places and in a survey of the route from Queensland and New Zealand to a point about 70 miles north of Fanning Island. The manufacture of the cable will be commenced next month, and the first expedition in connection with the laying of it is expected to leave the Thames in January, 1902. This will carry out the laying of sections from Queensland to Norfolk Island, Norfolk Island to New Zealand, and Norfolk Island to Fiji Islands. The second expedition will leave about August, 1902, and will lay the cable from Vancouver to Fanning Island and Fiji. This long length of cable, 5,834.5 nautical miles, will be transported and laid by one ship, which is now being specially built for the purpose. The contractors undertake that the whole of the cable shall be laid and working by December, 1902.

ELECTRIC RAILWAY DEPARTMENT.

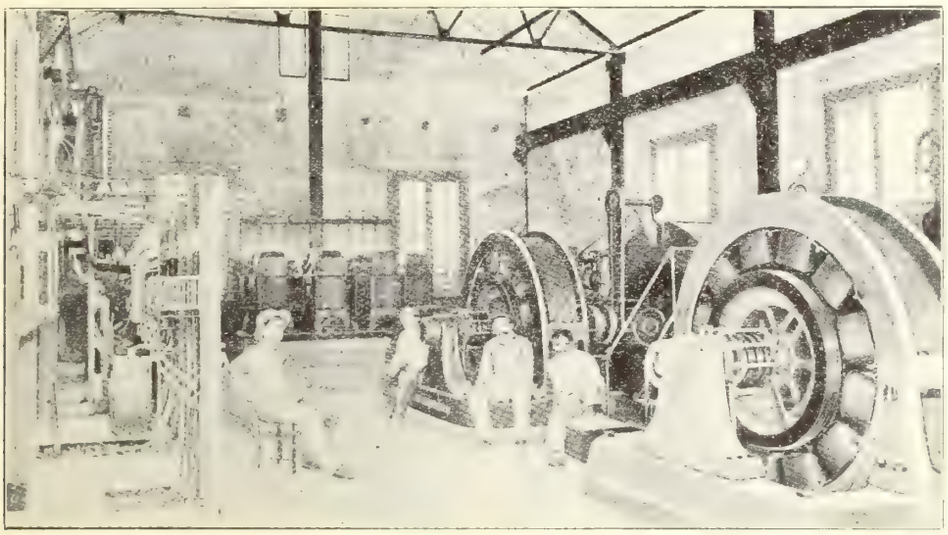
THE STREET RAILWAY SYSTEM OF KINGSTON, JAMAICA.

A street railway system, built according to the latest improvements in every detail, is now in operation in Kingston, Jamaica, a city with a population of 50,000. About two years ago the West India Electric Company, Limited, an organization composed of Montreal capitalists, obtained the franchise to build and operate extensive electric street railway and lighting systems. The old car company was absorbed, and in a short time works involving an expenditure of upwards of $1,000,000 had been completed.

The original intention to operate the railroad from a steam power plant was abandoned on account of the cost of coal, and it was decided to develop a water power on the Rio Colre, twenty-one miles from Kingston. The contract to design and install the power plant complete was given to the Stilwell-Bierce & Smith-Vaile Company, of Dayton, Ohio, who furnished their own designs and turned over to the company a finished installation. It happens that the Government road runs along the river bank at a height just sufficient to keep it above ordinary high water, but a location was finally found where a dam nine feet high could be built which would cause no inundation of the highway except at extremely high water, and the water could be piped to a lower point down stream, where a head of 54 feet is obtained.

The dam is built of concrete, and is 90 feet wide, with cross section. The intake of the pipe is ten feet in diameter, narrowing to eight feet. It is 6,240 feet in length and ¼-inch wheel riveted in six feet sections. It is one of the largest pipe lines in the world, and was constructed with untrained native labor, there being only two white men superintending the construction. The general superintendent was Mr. Henry Holgate, of Montreal.

The power house is built entirely of steel and concrete, and is carried on foundations from ten to sixteen feet deep. The building stands directly in the bed of the river and must needs be sufficiently strong not only to satisfactorily hold the machinery, but also to resist the freshets which come down, like all tropical floods, with tremendous force. The building is 70 x 36 feet, and is built with latticed columns and I beam girders throughout. The turbines are regular Stilwell-Bierce & Smith-Vaile wheels, designed to develop 400 h.p. at 40 r.p.m. The generators were manufactured by the General Electric Company. They are three-phase, stationary field, 12-pole, 300 k.w., 500 volt machines, designed to be used with step-up transformers, which are of the air blast type. Each generator feeds three transformers, which are connected with both secondary and primary in delta. The foundations for these transformers consist of concrete walls, 12 inches thick and 30 inches high, with a row of concrete piers down the centre. The air chamber is made by flooring the top of this foundation with 2 in. x 12 in. pitch pine plank. The low tension connections are made in the air chamber and are led through porcelain tubes into conduits in which they are carried to the switchboard. The high tension connections are made over-head and



Interior of Generating Station, West India Electric Company.

are let out of the building through 12 in. x 36 in. openings in the wall to cross arms, on which they are carried around the building to another set of openings, through which they are brought to the switchboard. The blowers are set on the floor directly at the west end of the air chamber, the motors being raised on concrete piers 12 inches high.

The switch-board consists of eight blue Vermont marble panels, two blank ones being left for the third unit. The high tension panels for each set of transformers contain only the high tension switches, which are of triple-pole, double throw, oil break form, the handle alone being on the front of the board. An auxiliary panel carries a triple-pole, single throw, oil break switch for paralleling the two transmission lines. All these switches are placed on the back of the board. The auxiliary panel is provided also with two astatic ground detectors and six ammeters connected to show the current in each phase. These ammeters are directly across the secondary of current transformers, thus avoiding all high tension in the front of the board. The generator panels are each equipped with three single-pole, quick break switches and the necessary

meters, field switches and synchronizing lamps. The exciter panels are equipped with the necessary switches and meters for two exciters, which operate at 110 volts. These exciters are four-pole, moderate speed machines of 25 k.w. capacity, each coupled directly to a single turbine 9 inches in diameter.

The low tension wires are all carried in conduits beneath the floor and rise only at the machines, switchboard and transformers. The high tension wires are carried on porcelain line insulators on wooden cross arms. From the transformer primaries they are run outside and are carried on long pitch pine cross-arms around to the middle of the west wall, through which they are carried directly to the high tension switches. There are two sets of bus-bars to which the two transmission lines are connected.

The transmission line is carried on two cross arms on tubular steel poles, four wires being on the upper, and two on the outer ends of the lower arm. Two telephone wires are carried on the lower cross arms next to the pole. There are six transpositions on the line, making two complete turns in the entire length, the transpositions being so made that the sets of three wires each spiral in opposite directions.

In the sub-station, which is of brick, there are two rotary converters, six pole, 200 k.w. capacity each. They are designed to run at 550 volts on the direct current end. The system being forty-cycle and the rotaries six-pole, they operate at 800 r.p.m. They are self-excited, compound wound, the compounding being done exactly as with a similar direct current generator, with the German silver shunt across the series field. When starting as a.c. motors there is, of course, a transformer action tending to induce a considerable potential difference across the field terminals. In order to avoid extremely high voltage across the shunt winding, the field coils are split up into three pairs of two inch series and are not connected until the machine is running synchronously. A switch is placed in series with the shunt to avoid a short circuited secondary effect through the series coils and the German silver shunt.

The step-down transformers are placed on a wooden air chamber, which in turn is placed over a duct or pit, through which the high tension wires run. The low tension cables run directly through a conduit to the switch-board. The primary leads are carried to a set of bus wires carried on short circuit cross arms on posts set between the two rows of transformers. These bus wires lead through the current transformers for the high tension meters to the oil break switches. The wires leading to the transmission line are connected directly to the high tension bus wire on the boards and pass directly down into the pit. Through the pit they are supported on line insulators on cross arms set in concrete on each end. At the opposite end of the pit they rise and pass up the wall behind the lightning arresters to two sets of cross arms, on which they are carried to the openings, through which the line enters.

The blowers and their motors stand on a wooden platform beyond the end of the air chamber, and are carried on the steel rails which cross the high-tension wire pit.

The switchboard in the sub-station is of blue Vermont marble and consists of nine panels, there being three for high-tension connections similar to those in the power house, one blank panel, two low-tension panels for the a. c. end of the rotaries, two standard railway panels for the direct-current side, and one feeder-panel for four feeders.

The step-up transformers step up to 14,000 volts, at which pressure the power is transmitted to Kingston, where it is stepped down to 345 volts for the rotaries. The relative field excitations are adjusted so that at about ¾ load the rotaries will operate non-inductively. The rotaries may be started from rest, from either the a. c. or the d. c. side. The usual custom is, however, to start the generator and rotary from no cycles, and with a full field on the generator. It was found that with weak fields on the generator and rapid acceleration of speed the rotary will pulsate in and out of step, frequently reversing the polarity of the d. c. voltage. This is avoided by bringing the generator up to speed slowly, and keeping a strong field on the same. The normal non-inductive, full load alternating current for the rotary is 340 amperes, but only 200 amperes are necessary to start it from rest, and bring it up to speed as an induction motor.

The switch-boards are provided with switches and a starting rheostat, so that either rotary may be brought up to speed as a direct-current motor, and, after synchronizing, be thrown in parallel on the a. c. end with the other rotary.

The general design of the plant is such that either generator unit can be operated on either transmission line, and either rotary unit the same. For its size it is one of the best equipped and best finished plants in existence; in fact, the entire system, including the dam, power plants, car sheds, track, and overhead work, is of the most substantial construction.

The accompanying illustration of the interior of the power house and much of the above information are taken from the American Electrician.

SCHOOL OF SCIENCE EXAMINATIONS.

In the spring examination in the Faculty of Applied Science and Engineering of the University of Toronto, the following obtained the degree of B. A. Sc.:

E. C. R. Ardagh, J. H. Barley, J. A. Craig, J. E. Davison, C. W. Dickson, W. E. Foreman, F. E. Guy, W. Hemphill, H. S. Holcroft, R. Latham, J. G. McMillan, E. V. Neelands, A. S. H. Pope, J. R. Roaf, H. W. Saunders, W. C. Tennant, S. M. Thorne, S. W. Thorold, H. M. Weir, H. A. Dixon.

The successful students in the mechanical and electrical engineering course were:

Third Year: Honors—W. G. Chace, A. Laidlaw, H. V. McVean, H. W. Price. Pass—W. G. Beatty, C. M. Bertram, W. J. Bowers, E. T. Brandon, W. P. Brereton, J. T. Broughton, C. A. Carmichael, A. G. Christie, J. R. Cockburn, N. R. Gibson, W. C. Lumbers, A. C. McDougall, A. T. C. McMaster, H. T. Middleton, M. V. Sauer, W. H. Stevenson.

Second Year: Honors—H. G. Barber, J. Breslove, C. Henwood, C. H. Marrs, P. Mathison, D. Sinclair, T. Taylor. Pass—J. M. Brown, H. V. O'Connor, R. J. Dunlop, W. Elwell, R. E. George, A. C. Goodwin, D. M. Johnston, A. H. McBride, J. T. MacKay, F. G. Mace, J. F. S. Madden, R. S. Mennie, H. D. Robertson, W. H. Sutherland, A. A. Wanless, H. Zahn.

First Year: Honors—H. H. Angus, F. A. Caby, A. J. Latornell, M. L. Miller, B. B. Patten, D. H. Pinkney, H. M. Shipe, S. B. Wass. Pass—H. G. Acres, J. A. Beatty, M. B. Bonnell, A. E. Davison, H. H. Depew, S. W. Eakins, C. J. Fensom, A. Gray, J. G. Jackson, C. K. Johnston, W. J. Larkworthy, J. A. McFarlane, C. A. Maus, W. G. Milne, P. H. Mitchell, E. E. Mullins, I. H. Nevitt, J. P. Oliver, J. D. Pace, R. B. Ross, H. S. Small, H. G. Smith, S. L. Trees, H. F. White.

In a car a small boy was observed to be suddenly agitated. Soon the conductor asked for fares. When he stood before the small boy there was a slight pause, and the passengers were surprised to hear the following: "Pleathe charge it to my papa; I've swallowed the money."

CURVES OF WEIGHT AND SPECIFICATIONS FOR ELECTRIC RAILWAY BRIDGES.

By H. G. Tyrell, Civil Engineer, Boston, Mass.

The curves shown in the accompanying diagram, prepared by H. G. Tyrell, C.E., of Boston, Mass., give the weights of electric railway bridges of spans from 5 ft. to 200 ft. for both light and heavy cars. The points adjoining the curves are actual weights, and from them the curves have been plotted. The weights include the steel only, without safety stringers. The spans are proportioned for either single truck or double truck

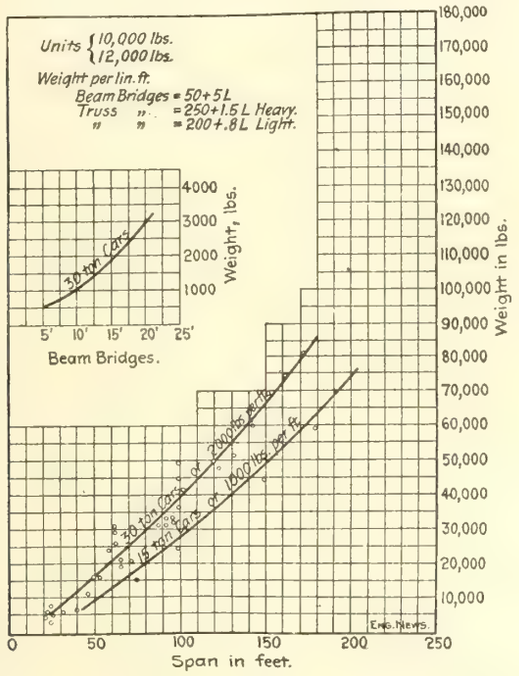


Diagram Showing Weights of Electic Railway Bridge Spans, from 5 ft. to 200 ft. in Length.

cars, and the load is considered to cover the span from end to end. Lighter bridges than these can, of course, be made by proportioning them for say two or three cars only on the span at one time. The units taken are 12,000 lbs. per sq. in. for tension and 10,000 lbs. reduced by Gordon's formulas for compression. The details are figured for riveted joints.

In connection with these curves it is interesting to note that the following specifications for electric railway bridges have recently been adopted by the Board of Railroad Commissioners of Massachusetts :

For bridge floors either a 20-ton 4-wheel car with 7-ft. wheel base, or a 30-ton 7-wheel car with 17-ft. total wheel base and 4-ft. truck wheel base is assumed. The fiber stresses to be used in the floor are as follows, the material being medium steel, namely : For I-beams 12,000 lbs. per sq. in. properly reduced according to the ratio of width of flange to total length, when this ratio exceeds 20 ; for plates and shapes, 12,000 lbs. per sq. in., in tension, and 12,000 lbs. per sq. in., reduced by the usual formula according to the distance unsupported ; for rivets in shearing, 10,000 lbs. per sq. in. and in bearing 16,000 per sq. in. for shop-driven rivets; field-driven rivets to be reduced 25% below these figures. No rivets less than ¾in. are to be used.

For trusses, uniform loads shall be assumed, varying according to the length which is to be covered by the live load to produce maximum stresses, from 1,500 lbs. per running foot per track for a loaded length of 100 ft. down to 1,000 lbs. per running foot of track for a loaded length of 300 ft., and proportionately for other lengths. Due account must be taken in the case of pieces which receive concentrated loading from the floor loads. The factor for trusses may be larger than that for the floor. The following may be the stresses per square inch : For tension, 15,000 lbs. per sq. in.; for compression, 12,000 lbs. reduced by the Rankine formula ; for rivets the same stresses should be used as for the floor.

ORIGINAL FORMULÆ FOR THE WEIGHT OF BRIDGES.

RAILROAD BRIDGES.

All weight are per lineal foot of single track bridge. Steel only.

Live loads, two engines, 100 tons each, and 4,000 lb. per lineal foot of track, units 10,000 lb. and 12,000 lb. per square inch.

Deck-plate girder bridge	100	+	9	l
" lattice " "	100	+	8	l
Half through plate girder bridge	300	+	12	l
Half through plate girder bridge, ties on shelf angle	200	+	8½	l
Half through plate girder bridge with solid steel floor	600	+	10	l
Riveted through truss bridge	400	+	6	l
" deck " " ties on top chord	200	+	7	l
Through pin bridge	400	+	5½	l
Deck pin bridge with stringers	400	+	6	l
Deck pin bridfie ties of top cord	300	+	6	l

RAILROAD TRESTLES.

Loads as above.

Weight of spans as above.

" bents and bracing = 9 lb. per square foot of side profile, from ground to base of rail.

ELECTRIC RAILROAD BRIDGES.

To carry 25 ton cars, or 2,000 lb. per lineal foot of tracks, units 10,000 lb. and 12,000 lb. per square inch.

Weight of steel per lineal ft. of single track bridge are for

Beam bridges	50	+	5	l
Deck plate girder bridges	50	+	4½	l
Pony truss bridges	250	+	1.5	l
Through truss bridges	250	+	1.3	l

ELECTRIC RAILROAD TRESTLES.

Weight of spans as above.

" bents and bracing = 6 lb. per square foot on side profile, from ground to base of rail.

HIGHWAY BRIDGES, WITH WOOD FLOORS.

Dead weight of floor = 40 lb. per square foot. Live loads, 100 lb. per square foot, and units 10,000 lb. and 12,000 lb. per square inch.

Weights are per square foot of floor, and include steel only, without joists.

Girder bridge with sidewalks	3	+	$\frac{l}{\ }$	
" " without sidewalks	3	+	$\frac{l}{\ }$	
Truss " with sidewalks	3	+	$\frac{l}{\ }$	
" " without sidewalks	5	+	$\frac{l}{\ }$	

HIGHWAY BRIDGES WITH SOLID FLOORS.

Dead weight of floor = 150 lb. per square foot.

Deck-plate girder bridges	3	+	$\frac{l}{\ }$	
Half through bridges	3	+	$\frac{l}{\ }$	
Truss bridge	3	+	$\frac{l}{4}$	

In the above l represents the length of span in feet, centre to centre of bearings.

TESTS OF JOURNAL BEARINGS.

Professor R. B. Owens, of the electrical department of McGill University, Montreal, and Mr. J. B. Ingersoll, E.E., chief inspector of rolling stock of the Montreal Street Railway, have just completed some interesting experiments with a new roller bearing designed for all kinds of vehicles, from railway coaches to vehicles for ordinary street traffic. Street cars on the St. Catherine street route from Maisonneuve to Westmount were used, and the object was to show how much electrical power could be saved by the new device when contrasted with the journals at present in use on the street railway cars. The street cars are at present equipped with the standard journal bearing, and the journey of 10 6-10 miles covered with a large number of street corner stops consumed 15,200 watts, or 20.37 horse power, while the Wright roller bearing journal consumed 10 1-20 watts, or 13.43 horse power. The two cars used were alike and were loaded to represent 42 passengers. The testing instruments used were Thompson-Houston recording wattmeters.

TELEGRAPH and TELEPHONE

THE DYNAMO IN RECENT TELEPHONE PRACTICE.

An inspection of a modern telephone exchange reveals many interesting departures from the standard practice of a few years ago. This is especially true of the latest development in the telephone field, the central energy of common battery system. In this method of operating an exchange the subscribers' local battery and calling generator are dispensed with and the energy necessary for the signaling and talking currents are supplied by a suitable plant of the central office and distributed throughout the system. In an exchange, therefore, of any reasonable size the amount of power to be continuously taken is much greater than is usually supposed to be necessary in telephone work ; hence it is a matter of considerable importance when remodeling or equipping new systems to give the most careful consideration to the generating devices and to arrange it in accordance with modern engineering practice.

Most of the generating apparatus required for modern telephone work is distinctly special in character, and cannot be purchased in the local market. A description, therefore, of apparatus which may be considered standard for supplying exchange systems, its location and the most desirable arrangement of circuits, will, no doubt, prove of interest to those engaged in the telephone field.

Considering, first, the source of direct current for transmitter service, the storage battery has been and is still very largely employed. Its low internal resistance, high e.m.f., compactness and great current capacity render it particularly well adapted for common battery service.

Fig. 2 shows a good arrangement of circuits using storage battery in duplicate, with means for charging furnished by a dynamo of the ordinary description. It will be noticed that one set of batteries is continuously on the system while the other set is being charged ; all necessary connections between the lines, batteries and the charging mains being effected by means of double-throw, double-pole switches so arranged that there is no danger of interrupting the service.

It is of vital importance that storage batteries of whatever make or description have systematic and intelligent care. If properly installed and attended to they give excellent service at a moderate expense, but if from any cause deterioration of cells once sets in, effective service will be impossible, and the life of the batteries will be greatly shortened, to the discredit of the storage battery rather than the management, which in nine cases out of ten is responsible for such a result.

The proper care of storage cells, the location and cure of their troubles can only be learned by practical experience, and only men who have had the training should be put in charge of this important part of a modern exchange equipment.

The charging machine is usually of the shunt-wound type, wound for a maximum pressure of about thirty-five volts. If for any reason a compound-wound machine is used, means should be provided for shunting the series winding while the cells are being charged, the charging pressure being regulated in the usual manner by a shunt field rheostat as shown.

Both gas and gasoline engines have been used with success for operating charging dynamos where the local condition allow of their use. But as exchanges are often built in residental districts, it may be found necessary in some cases to drive by electric motor and thus avoid a frequent source of complaint where gas engines are used.

When only one set of storage batteries is used, or where it is intended to operate a system directly from the dynamo, the selection of a suitable generator for this service is a matter of great importance, and telephone engineers should not be misled by the idea that the ordinary bi-polar and multi-polar design, however successful it may be for lighting and power purposes, will be suitable for telephone work. While the current they generate is direct, it is not of a sufficiently steady character for transmitter service.

Modern dynamos are built with slotted core armatures and a high-field density. This, with the high self-induction and comparatively few number of coils in the armature, combine to produce a current which is so noisy in the telephone circuit as to make intelligible conversation impossible ; no better proof of this can be furnished than listening on a telephone circuit subject to leakage and excessive induction frequently found on telephone systems. In these cases the disagreeable hum and buzzing of railway and lighting circuits is a serious hindrance to conversation, and if this is the case with the comparatively feeble currents induced in such a circuit, it can be readily seen that a machine of this type feeding a telephone system directly is out of the question, and no arrangement of choke coils and condensers will remedy or remove this defect.

A dynamo for direct service or for use in multiple with storage batteries must deliver a current perfectly free from pulsation, and the commutator and collecting device must be of such a character as to eliminate any possibility of imperfect contact at this part of the machine. These desirable results can only be reached by having a machine designed especially for telephone service.

It is of the multipolar type, the armature is smooth or surface wound with a great number of coils of only one turn each, and connected to a commutator having an equally large number of segments. The induction in the field is comparatively low, and the pole shoes are so shaped that any given coil enters the field in a very gradual manner regardless of the speed at which the armature is running. The brushes are of finely woven copper wire so that perfect contact is obtained at all times with the commutator, and the very slight pulsations in the current are so rapid in character as to be inaudible.

With this machine a very slight whistle is noticed at times, which is due to the action of the brushes on the commutator, and which is entirely corrected by impedence or choke coils.

The dynamo has become practically a standard with several leading telephone companies and solves quite a serious problem in the power equipment of most common battery systems. The largest size known to the writer is of ten-kilowatt capacity, which is in use in several of the exchanges of one of the leading sub-companies. A smaller size very much in demand is

rated at three-quarters kilowatt, delivering a current of twenty amperes at thirty to thirty-five volts.

In some cases, when used in connection with storage batteries, these machines are compounded, provision being made for short-circuiting the series coil when batteries are being charged; at other times the dynamo feeds the circuits directly. A machine of this sort renders unnecessary the use of a spare or duplicate set of storage cells, or where power can be obtained at all times, the cells may be dispensed with entirely.

Referring again to Fig. 2, the storage batteries in two equal groups, Nos. 1 and 2, are connected to independent double throw switches. The generator, G, is a plain, shunt-wound machine, with a field regulating rheostat, R; the latter should have a large number of contacts so as to give the closest regulation and should have sufficient resistance to give a suitable variation of pressure at the dynamo terminals.

The dynamo leads are connected to a main double-throw switch, as shown. This switch in one position will connect the dynamo to the battery charging mains, and when thrown to the lower position will be connected directly to the main telephone bus-bars, so that if the

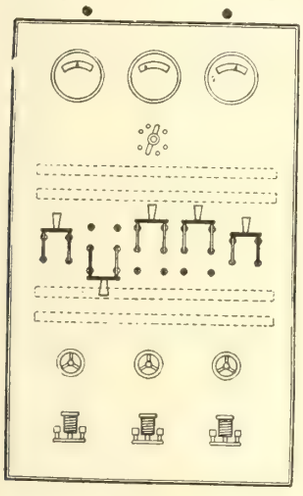


FIG. 1.

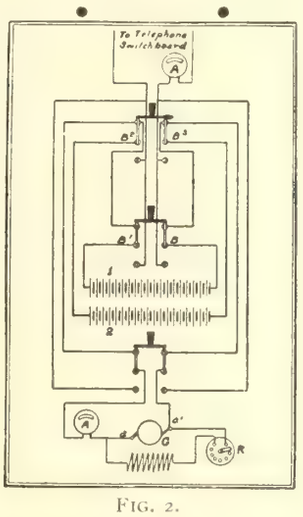


FIG. 2.

machine is of the noiseless type it may be used in case of accident to the battery system to support the telephone circuits directly. As arranged in this diagram the battery switches when thrown to their upper contacts will connect the battery to the charging dynamo, and when thrown down will be connected to the telephone mains.

An ammeter should invariably be used on the dynamo circuit, and in the telephone mains. It is also convenient, though not absolutely necessary, to have one in each of the battery circuits.

A voltmeter with a suitable switch should be arranged so that the pressure can be taken from A, A1, B, B1, B2, B3. It is essential for good service that the ammeters and voltmeters should be standard and of first-class construction. A low-priced instrument usually proves a very costly investment in the long run, as the readings, not any too accurate at first, soon show such a large error that they are practically worthless and liable to lead to serious results, especially when used with storage cells.

Referring to Fig. 1, in which the details of the switchboard are shown, this arrangement has proved very satisfactory in practice, and as here illustrated, corresponds to the system shown in Fig. 2; the voltmeter switch being placed in the center with the dynamo and main circuit ammeters on each side. The double-throw dynamo switch is in the center with the double-throw battery switches on either side.

One of the two smaller switches shown at the outside of the board is used for the motor switch when the generator is motor-driven. The other switch at the opposite side of the board is for connecting in the ringing or pulsating current generator.

Immediately below the main dynamo switch at the center of the board is the field regulating rheostat for the charging dynamo; while the small rheostats at either side control the motor and ringing generator, respectively.

Circuit breakers at the lower part of the board are shown, and it will be found in practice that automatic circuit breakers of standard make are much to be preferred to the uncertain and unsightly fuse.

The switchboard should be made of the best quality of slate, free from veins, if possible, and filled by driving paraffine into the pores of the stone by means of a gas torch and blow-pipe. This precaution is quite necessary where good insulation is required, as in a switchboard of this character 500 volts is quite frequently used to operate the motors and motor generators.

A very frequent error in erecting a switchboard is placing the board too close to the wall or partition. It should stand out as far as possible, with plenty of room and light for making connections, inspecting and cleaning the back of the board. The connections to the bus-bars, switches, etc., should be most thoroughly soldered or connected by heavy well-fitting bolts.

Considerable energy is frequently lost by imperfect contacts, and it should not be forgotten that the small area of contact or conductor necessary to carry the currents formerly used for telephone work are totally inadequate for the proper handling of large currents used in the common battery systems.

It is to be regretted that the manufacturers of storage batteries are so interested at the present time with light and power equipments that very little information regarding the storage battery as applied to telephone service is available for the telephone engineer. Descriptive bulletins without number of central station and isolated lighting plants may be had for the asking, but so far as the writer knows, nothing relative to telephone service has been published.

It is possible, however, that the fault is not altogether with storage battery manufacturers, but partly due to the reluctance of telephone companies to publish their plans of installation. This antiquated policy on matters of general interest to the profession is to be deplored. It has been abandoned to a great extent in the other branches of engineering, and there is no good reason for its continuance in telephone practice.

When noiseless dynamos of proper construction are used one of the batteries may be dispensed with to advantage, and the dynamo and central battery run in multiple, provided proper arrangements are made to take care of the increased pressure required during the period of charging.—D. M. Bliss, in Electrical World and Engineer.

The big telegraph suit of Morrow vs. the Great North Western Telegraph Company and the Western Union Telegraph Company, to annul the lease of the Montreal Telegraph Company's lines by the G.N.W. Company, has been settled out of court, in favor of the defendants, after over a year of litigation. Each side, it is understood, will pay its own costs.

SPARKS.

The village of Strathcona, N.W.T., will probably install an electric light plant.

A by-law has been carried to have the streets of Embro, Ont., lighted by electricity.

McArel Bros., of Glace Bay, C. B., are installing an electric light plant of their own.

Cruise & Cummings, electricians, Sydney, N.S., have been succeeded by A. W. Cruise.

The Kootenay Electric Supply & Construction Company, Nelson, B.C., has been dissolved.

The ratepayers of Thessalon, Ont., have voted in favor of installing a municipal electric light plant.

The town of Blenheim, Ont., has just taken tenders on the installation of a municipal electric light plant.

A movement is on foot in Victoria, B. C., to have the telephone and electric light wires placed underground.

The capital stock of the Plessisville Electric Company, of Plessisville, Que., has been increased to $60,000.

The Sarnia Electric Street Railway Company are still considering the extension of their road to Point Edward.

A by-law to purchase the electric light plant for $27,000 was carried by the ratepayers of Parry Sound on May 6th.

The Kay Electric Dynamo & Motor Company, Limited, of Toronto, has been incorporated, with a capital of $40,000.

A by-law to raise $8,000 for electric lighting purposes was defeated by the ratepayers of Strathcona, N.W.T., recently by one vote.

Stayner, Ont., is looking into the question of developing the water power of the Nottawasaga river for the production of electricity.

A by-law will be submitted to the ratepayers of Brockville, Ont., to provide money with which to improve the electric light and gas plants.

The municipal power plant for the town of Orillia, Ont., is at last nearing completion. According to report, the work will be finished within a month.

Midland, Ont., is considering municipal control of electric lighting. A by-law to take over the present plant will be submitted to the ratepayers.

The Slade Electric Company, of Quebec, have been awarded the contract for wiring for electric light the grain elevator of the Quebec Terminal Company.

It is stated that a rival concern is preparing to submit figures for lighting the streets of Portage la Prairie, Man., in opposition to the Central Electric Company.

The ratepayers of St. Mary's, Ont., will vote on a by-law on July 8th to provide $15,000 for the extension and improvement of the waterworks and electric light plants.

The Peterboro Hydraulic Power Company are about to build a dam and develop electric power to be supplied to the American Cereal Company and other concerns.

The Emerson Incandescent Light Company, of Ottawa, has been incorporated, with a capital of stock of $800,000, to manufacture light, heat and power apparatus, etc. The provisional directors include V. L. Emerson, S. R. Poulin and Leopold Meyer, all of Ottawa.

Members of the Vancouver city council recently visited Seattle, Wash., in search of information upon the subject of municipal electric lighting. The British Columbia Electric Company, by whom the lighting is now done, charges $1.78½ per arc light per week, while the Stave Lake Power Company, a concern just organized, have made an offer of 90 cents per arc light.

The town council of Goderich, Ont., have accepted a proposition made by the Maitland River Power Company to deliver to the town for ten years from the date of installation of their plant the power necessary to run the arc and incandescent lighting systems and for pumping water supply at the following rates: The first 200 h.p., 24 hour day, at $30 per h.p. annually, used or unused; the next hundred h.p., 24 hour day at $25 per h.p. per annum; the next hundred, 24 hour day, at $23 per h.p. per annum; price per h.p. over that amount to be regulated by arbitrators chosen by the council and company. The council to grant the right of carrying line of transmission alone the municipal thoroughfares.

A bill regarding the inspection of steam boilers is now before the British Columbia legislature.

The Galt Gas & Light Company have been awarded a five year contract for lighting the streets of Galt, Ont.

The Chambers Electric Light & Power Company, of Truro, N.S., have installed two new dynamos of 1,200 capacity each.

The town council of Rat Portage, Ont., have made the Citizen Telephone & Electric Company an offer of $30,000 for their plant.

The contract with the Lachine Rapids Hydraulic & Land Company, by which Westmount, Que., is lighted, will expire in December next, and the citizens are discussing the advisability of installing a municipal plant.

Although the contract for electric lighting the streets of Montreal does not expire for about two years, the city council are now inviting tenders for a renewal of the contract. The tenders are to be received by June 15th, and to be accompanied by a cheque for $50,000.

A meeting of delegates representing the Electrical Worker's Union, of London, Hamilton, Brantford, Montreal, Toronto and St. John, N.B., was held in Toronto a fortnight ago. Two delegates were appointed to attend the annual convention of the International Union in St. Louis, Mo., next October, and it is understood that the question of shorter working hours was discussed.

The Applied Science Society of McGill University, Montreal, have elected the following officers for the session of 1901-02: President, C. M. Campbell, '02; vice-presidents, J. N. Hicks, '02, and H. P. Borden, '02; secretary, Jas. C. Ross, '03; treasurer, O. Hall, '03; second year representatives, E. J. Carlyle, '04, and G. O. McMurtry, '03; reporters, H. Biggar, '02; F. E. Sterns, '02; C. Rowlands, '03, and J. Egleson.

Mr. William M. Doull, secretary of the Cuban Electric Company, returned to Montreal last month from Havana, where Canadian capitalists are building an electric railway. Mr. Doull was in Havana when the first section of the road was opened for traffic. The first start made was on ten miles, and the company found their cars insufficient to accommodate the crowds which wished to avail themselves of the new system of travel.

The Almonte Electric Light Company have refused the offer of $10,000 made by the town for the purchase of their electric light plant. At a recent joint meeting of the council and members of the company, the company agreed to withdraw the suit to quash the electric light by-law, each party to pay its own costs. An attempt will now be made to arrange a price for the plant, and in case of failure within thirty days, arbitration will be resorted to.

Recently the city council of Belleville, Ont., invited tenders for lighting the streets and public buildings of the city. The competitors were the Trenton Electric Company and the Belleville Gas Company. The tender of the former company was accepted. They agree to furnish 30 arc lamps of 2,000 candle power, and as many more as may be required during the contract, at $58 per year; also not less than 200 incandescent lamps of 32 candle power at $10 each per annum. Private consumers to be supplied at rates varying from $2.25 per lamp up to five lamps, down to $2.50 for 30 lamps or over. The contract is for five years.

The Bridgetown Electric Light, Heat & Power Company have secured a contract with the town for lighting the streets for five years. The contract calls for thirty-five 32 candle power lights, and for an all night service at the price of $20 per light per year. The contract also fixes a schedule for private lighting within the town: 16 c.p. house lights up to five lights, are rated at 1½c.; five to ten lights, 1¼c.; and over ten, 1 cent per light. 12 c.p. lights will cost 1¼c. up to five, and over that, 1 cent per night. Store lights, 16 c.p. will be charged at 2c. per light up to ten lights, and 1¾c. for more than ten. Church lights are to cost not more than $1.50 per light per year. The all night service is to go into effect not later than August 1st, 1901.

At a recent session of the Nova Scotia legislature the following acts were assented to: To enable the town of Lunenburg to borrow money for water, electric light and sewerage purposes; town of Annapolis Royal, to borrow money for electric light purposes; town of Parrsboro, to borrow money to extend their electric light plant; town of New Glasgow, to borrow money to provide a fire alarm system; to incorporate the Bedford Electric Company, Limited, Nova Scotia Electric Light Company, Limited, Oxford Electric Company, Limited, Mahone Bay Electric Light & Power Company, Limited, Blockhouse Electric Light & Power Company, Limited, Eastern Telephone Company, Limited, Valley

Telephone Company, Limited; and an act respecting the Chambers Electric Light & Power Company.

Mr. J. H. Jewell, of Toronto, is negotiating for the establishment of an automobile factory at London, Ont.

The ratepayers of Thorold, Ont., will vote on a by-law on May 13th to provide $6,000 for the extension of the electric light plant.

The city of Winnipeg is about to invite tenders for the supply of fifty arc lamps. It is probable that another dynamo may be purchased.

Mr. Joseph Barrett, who has the contract to supply Toronto Junction with electric power, is said to have sold out to the Humber Power & Light Company.

Last January Mr. Thos. Welsh, of Hensall, Ont., bought the electric light plant from Mr. H. Cook. He has built a new power house, brick and stone, 36 x 40 feet, and installed new Bell engine and Leonard boiler, heater and steam pump. He has a 60 k.w. inductor alternator of the United Electric Company's build, with E.B.T. exciter and marble switchboard complete. He has also installed 300 light capacity in Packard transformers, type L, and built new main wires. He is installing more lamps right along and hopes to reach 1000 by fall. The whole plant was installed by and is now in charge of Mr. J. H. Ward, late of Exeter, and is giving thorough satisfaction.

PERSONALS

Mr. M. J. Kennedy has been appointed superintendent of the Montreal street railway, to succeed Mr. Duncan McDonald.

Mr. J. W. Marr, of Toronto, has been appointed superintendent of the power house of the Niagara Falls Park and River Railway.

Mr. Wm. N. Campbell, formerly with Messrs. J. D. McArthur & Co., of Toronto, has recently accepted the position of travelling representative in Ottawa of the Reeves Pulley Co., Toronto.

Mr. Harry Rolfe, of the International Correspondence Schools, Scranton, Pa., has accepted an important position in the mechanical engineering department of the Westinghouse Electric and Manufacturing Company, Pittsburg, Pa.

Mr. Charles L. Farrer, of Parry Sound, Ont., who has lately been in the employ of the Lachine Rapids Hydraulic & Land Company, of Montreal, has been appointed superintendent of the Canadian Electric Light & Power Company's plant at Chaudiere Falls, Que.

Mr. William C. Hubbard, representative of the Manhattan General Construction Company, with offices at 11 Broadway, New York, recently visited Toronto, Montreal, Ottawa, and other Canadian cities, in the interest of the Manhattan Company, which is giving increased attention to Canadian business.

The death is announced of Richard P. Rothwell, one of the founders of the American Institute of Mining Engineers, and for upwards of thirty years editor of the Engineering and Mining Journal. He was also a successful inventor on the line of mining apparatus and metallurgical process. Mr. Rothwell was a Canadian, having been born at Ingersoll, Ont., in 1837. He was educated at the Rensselaer Polytechnic Institute, the National School of Mines, Paris, and the Frieberg Mining Academy.

Mr. E. K. M. Wedd, purchasing agent of the Canadian General Electric Company, is now numbered among the benedicts. On April 26th he was united in marriage to Miss Mattie Garvin, of Brooklyn, N.Y. The event was made the occasion of the presentation, by the staff of the Canadian General, of a handsome cabinet and chair and a gold mounted umbrella, accompanied by an address expressing the esteem and regard in which Mr. Wedd is held by his confreres in the office. We join with their numerous friends in wishing Mr. and Mrs. Wedd many years of happiness.

TRADE NOTES.

The Dodge Manufacturing Company, of Toronto, have in work a number of large friction clutch pulleys for the Smith's Falls Electric Light & Power Company.

The Goldie & McCulloch Company, of Galt, Ont., are supplying shaftings, pulleys, etc., for the new works of the Grey & Bruce Cement Company at Owen Sound, Ont.

Mr. Emerson McMillan, of New York, is said to be making arrangements to consolidate a number of gas light, traction and water power companies throughout the United States and Canada. The Jacques Cartier Water Power Company, of Quebec, is named as one of the companies to be included in the deal. The combined capital of the proposed corporation is about $35,000,000.

Our readers are asked to note the change of address in the advertisement of the Weston Electrical Instrument Co., from "114-120 William St., Newark, N. J.," to "Waverley Park, Essex Co., N. J."

The Northey Manufacturing Company, of Toronto, are constructing what will be the largest electrical single pumping engine in Canada. It is being built for the Montreal Water & Power Company, will have a capacity of 5,000,000 gallons every 24 hours, and will weigh 200 tons.

The Dodge Manufacturing Company, of Toronto, are installing the heavy jack shaft of hammered steel, floor stands with ball and socket, self-oiling pillow blocks, large split pulleys, couplings, etc., for the new power plant of the Lincoln Electric Light & Power Company, of St. Catharines, Ont.

Education has always hitherto been regarded as the peculiar privilege of youth. If anyone was compelled to leave school insufficiently trained for the work of life, his case was commonly supposed to be beyond remedy. Hence, until the International Correspondence Schools, Scranton, Pa., were established, no attempt had ever been made to reach men and women engaged in earning a living, with an organized course of study intended to fit them for higher efficiency in their chosen pursuit, or to train them for another. The Schools are now doing this important work for thousands in middle life and beyond. Such as these value educational opportunities most highly and know exactly what they want. "Success that comes after many years is the best."

The Packard Electric Company, of St. Catharines, announce that, owing to ill health, Mr. E. E. Cary has resigned his position as manager of the company, which position has been accepted by Mr. R. B. Hamilton, who, during Mr. Cary's illness of the past two months, has been acting manager. The company state that Mr. Hamilton's technical education and practical experience are a guarantee that the excellence of the Packard product will be fully maintained and advanced, and important improvements have already been inaugurated, with most satistying results. Mr. Geo. A. Powell, who has been absent for the past four months, has returned, and will assume the management of the sales department.

The S. Morgan Smith Company, of York, Pa., have recently installed the heaviest pair of water wheels that has ever been built in America. They are of the McCormick type, 54 inches, each in a separate iron case, discharging into a cast iron chest and draft tube. The power is used for operating a large air compressor and generator in the power plant of the Boston & Montana Consolidated Silver & Copper Mining Company, of Great Falls, Mont. The outfit weighs 300,000 pounds, not including the power connections, draft tubes or supply pipes. The wheels were tested at the Holyoke testing flume, and are said to have shown an extraordinary efficiency, developing 2,800 h. p. under a head of 40 feet. The speed is controlled by type "B" Lombard water wheel governors. The gates are so accurately balanced that one man can operate the gates of both wheels with ease. The S. Morgan Smith Company have lately completed additions to their works, and have the largest and one of the most complete water wheel plants in the world. An illustration of the turbine in the Boston & Montana Mining Company's plant is shown in their advertisement on another page.

NATIONAL ELECTRIC LIGHT ASSOCIATION.

The annual convention of the National Electric Light Association of the United States will be held at Niagara Falls, N. Y., on the 21st, 22nd and 23rd inst. For three days previous to and following these dates, the railways on both sides of the line will grant to delegates to the convention a transportation rate of a fare and a third on a certificate plan.

The Niagara, St. Catharines & Toronto Electric Railway Company is announced to have purchased the Port Dalhousie, St. Catharines & Thorold Electric Street Railway from Messrs. Dawson & Symmes, of St. Catharines. The road runs from St. Catharines to Thorold and was one of the first electric street railways built in Canada. The purchase price is given as $90,000. The road will be put in first class condition, with improved roadbed and new rolling stock.

ENGINEERING and MECHANICS

CONDENSATION IN STEAM PIPES.

W. H. Wakeman, in The Engineer.

As soon as steam leaves the boiler in which it is generated, it begins to go back to water, so that the intelligent engineer is constantly watching for improved methods for preventing condensation before it is wanted. It is not the object of this article to describe plans for accomplishing this desirable object, but to show how much steam is condensed in pipes under given condition, for there is not as much available literature on this subject as there should be.

Experiments made by reliable parties several years ago, which are as valuable now as when first made, show that a very little change in the conditions make a considerable difference in the results obtained. Putting the results together and taking the average of them shows that when the number of square feet of pipe surface exposed to still air is multiplied by the difference in temperature between the air to be heated and the steam inside of the pipe, and the product divided by the number of pounds of water obtained per hour by condensation, the quotient is practically 420. This result has been accepted as reliable for a long time, so that a rule for determining the amount of condensation in pipes, based on these results, is as follows: Multiply the number of square feet of pipe surface by the difference in temperature between the air in the room and the steam in the pipe. Divide the product by 420 and the quotient will be the pounds of steam condensed into water per hour.

For example, suppose that we have 300 square feet of pipe, carrying 90 pounds pressure, in air at 50 degrees f. The temperature of steam at 90 pounds is 331 degrees, making the difference $331 - 50 = 281$. Then $300 \times 281 \div 420 = 200$ pounds of water per hour.

As before mentioned, this rule is based on favorable conditions, which means that the air was nearly still. When the air is in motion the condensation will take place much faster, so that it becomes difficult to determine just how much it is except by direct experiment.

This fact has become much more prominent since the forced blast system has become popular for heating and ventilating. It is customary to multiply the results obtained by the foregoing rule, by a factor which varies from 2 with gentle circulation to 5 with a rapid movement of the air. Which shall be used must be determined by the engineer according to his best judgment.

In some cases it is necessary to carry steam for a long distance, and it is desirable to know how much the loss will be under given conditions, for if it promises to be excessive the necessary provision must be made for it.

In a letter to The American Machinist, F. A. Nystrom gives the details of observations made to determine the amount of water resulting from condensation of steam in pipes exposed to the outside air without protection of any kind; 217 feet of 8-inch pipe, 219 feet of 7-inch, and 258 feet of 6-inch were put up with so much pitch that all of the water traveled to the end of the system, where it was caught and weighed. Assuming that all of this pipe was ¼-inch thick, there were 483 square feet of the 8-inch, 430 of the 7-inch and 438 of the 6-inch, making a total of 1,351 square feet. The pressure was 90 pounds, the temperature of which is 331 degrees f., and the plant was located where the outside temperature did not vary much from 64 degrees f., so that the difference was 267 degrees.

Under these conditions the condensation amounted to 1,440 pounds per hour, and as the test lasted for twenty days, there is much less chance for securing unreliable results than if it was for one day, or perhaps a few hours only.

Now, when we proceed as in the first rule illustrated and explained, we have $1,351 \times 267 \div 1,440 = 250$, which shows that in order to determine the amount of condensation in steam pipes that are exposed to the outer air, which means that they are not protected from the weather, we may proceed as follows: Multiply the square feet exposed to the air by the difference between the temperature of the steam and the outer air, and divide by 250. The quotient will be the pounds of steam condensed per hour.

This experiment was carried further, making it still more valuable, for the pipe was covered with a fairly good nonconductor of heat and the results obtained for another period of 20 days were carefully noted. The total condensation was now reduced to 195 pounds per hour, and when we multiply 1,351 by 267 as before and then divide by 195, the quotient is 1,850. From this we may formulate a rule for determining the weight of steam condensed in well covered pipes, as follows: Multiply the number of square feet on the surface of the pipe by the difference between the temperature of the steam and the air, and divide by 1,850. The quotient is the pounds condensed per hour. In this case it is $1,351 \times 267 \div 1,850 = 195$ pounds per hour.

Right here I wish to insert a few lines about rules and formulas. The man who believes that rules which are printed in a mechanical paper or in a book, are written by somebody who really knows nothing about the subject, is occasionally in evidence even at this enlightened period of the world's history, therefore he believes in nothing but what is the direct result of some of his own practical experiments. This type of man is not wholly useless, because he keeps some of the rest of us from becoming too theoretical, but I wish to call his attention to the fact that the rules which I have given are based directly on the results obtained from experiments, and are as simple and as practical as the process of putting a load of coal on the scales and weighing it. In a great majority of cases the rules found in standard works are based on practice, and where they do not seem to apply to a given case, it is usually because some of the conditions do not agree with those under which the rules were formed.

The saving made by covering this pipe is worthy of a passing notice. In the first case the condensation was 1,440 pounds per hour, but in the second case it was reduced to 195 pounds, a difference of 1,245 pounds. If the hot water was not used for some good purpose the heat required to evaporate it was lost and coal was wasted accordingly. If the boiler evaporated 8 pounds of water for each pound of coal burned under it, then it required $1,245 \div 8 = 155$ pounds of coal per hour, or 1,550 pounds per day of 10 hours, and this was a total loss.

WATER AS A LUBRICANT.

Mr. D.R. Munro, of Wolfville, N.S., at the request of a St. John engineer, furnishes the following account of his experience in running an engine with water as a lubricant: I have been running our 125 h.p. Leonard Peerless Compound Engine (self-oiling type) for over five months with nothing but water to lubricate the main working parts. It came about partly from experiment and partly from necessity, being short of oil at the time. The results have been most remarkable and satisfactory. Before using water I was obliged to adjust the engine occasionally particularly the wrist pin, quite frequently (which is a weak point in any engine). Now since water has been used as a lubricant there has been no adjustment whatever for five months, and to-day the engine is running perfectly, although very heavily loaded. I am quite sure the idea is entirely original, and anyone using water instead of oil in this type of engine will never use oil again, as water is so much less trouble. When using oil I found that the churning it got caused it to disappear in the form of vapor, I suppose. This is how I began to use water to raise the oil in the reservoir after it had become so low that the crank discs would not touch it. I kept on adding more water when necessary, until the oil entirely disappeared add left nothing but water. Another good feature is that while oil continues to grow less, the water, on the other hand, accumulates, due to drip from piston rod, so there is no possibility of the engine running dry. I was somewhat anxious about rusting at first, but find all the parts remained perfectly clear and bright.

A local company has been organized at Cranbrook, B. C., for the purpose of installing telephones.

Messrs. Ness, McLaren & Bate, of Montreal, have made extensive improvements to the telephone exchange at Pontiac, Que.

The Bell Telephone Company are understood to have made an offer to purchase the interests of the Victoria County Telephone Company, of Lindsay, Ont.

The Nova Scotia Telephone Company are negotiating for the acquisition of the property and franchise of the Eastern Telephone Company, whose lines extend to Baddeck.

THE BOILERS OF THE PAN-AMERICAN EXHIBITION.

The boiler plant of the Pan-American Exhibition, which is to be held at Buffalo, N.Y., U.S., this year, will be stationed in a separate building across the canal to the west of the machinery and transportation buildings, the steam main being brought under the bridge to the boiler-house. The steam will be furnished by four Climax water-tube boilers. These will be about 13 ft. external diameter, will stand over 31 ft. high to the base of a 48 inch chimney stack, and will have a minimum evaporative capacity of 15,000 lb. of water per hour each. They will be fired with natural gases, but will have the regular coal grates covered with firebrick, so that in case of the failure of the gas supply the covering can be removed, and the boiler run with coal, without serious interruption of the service.

SPARKS.

A charter has been granted for an electric railway from London to Port Burwell, Ont.

The town of Gottingen is to be the first in which Nernst lamps are to be used for lighting.

The Von Echa Company, of Toronto, have made a proposition to build an electric railway beween Galt and Brantford, Ont.

A charter for an electric railway in the town of Amherstburg, Ont., has been granted to the South Essex Electric Railway Company.

The electric street railway at Moncton, N.B., is announced to have been sold to an American syndicate, and it is said that the rails will be taken up and the plant removed.

The Cornwall Electric Street Railway Company have purchased the property of the Cornwall Milling Company and purpose utilizing the water power for the operation of their electric railway. They purpose putting in modern water wheels and dynamos. The present plant will be retained as an auxiliary.

The British Columbia Electric Company have just completed an addition to their power house at Goldstream, B.C., by means of which their lighting capacity will be doubled.

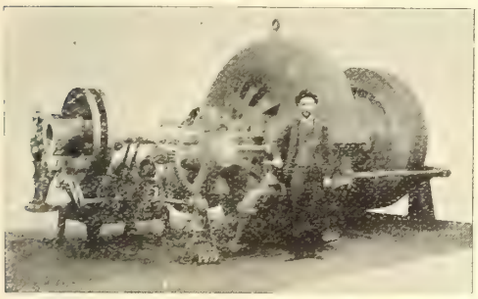
Plans are completed for the construction of an electric railway in Sydney, Cape Breton. The Cape Breton Electric Company have made a proposition to the town to build five miles of track in Sydney, six at Glace Bay and seven in the county. They have also asked for a franchise to supply electric light and power. Messrs. B.F. Pearson, of Halifax, and a number of Boston gentlemen are interested.

It is reported that the Ottawa Electric Company purposes notifying the city council that in the event of a franchise being granted to any or all of the new companies now applying, it will put back the rates to the old figures. The company takes the ground that if the city now admits other companies to do business it will be a breach of the agreement, and will be followed by a raising of the rates to the former figure. In view of the reduction which the company made in the price of light to consumers, the council agreed that no charter would be granted to an opposition company.

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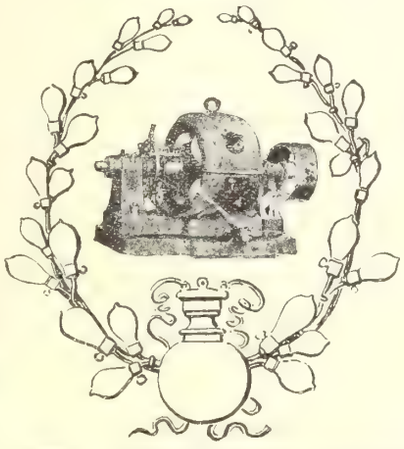
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A NEW CORD ADJUSTER.



The Canadian General Electric Company have recently introduced a novel cord adjuster, of which two illustrations are herewith given, one showing the spool without cord and the other cut with the cord taken up, so that the usual unsightly loops are done away with. Among its many other features a few may be briefly stated—quickly attached, cannot slip, self locking, etc. The cord adjuster is known at the Universal cord spool, and the above company report a ready sale of this useful little device.



SPARKS.

The report comes from Pittsburg that representatives of the larger manufacturers of glass lamps and electric glass ware, whose combined sales reach $6,000,000 per year, have agreed to enter a "combine" with a capital of $5,000,000 or more, under a New Jersey charter.

The Universalist Club of New York city recently gave a banquet at the Hotel St. Denis. Among the addresses was one by a principal of the International Correspondence Schools, Scranton, Pa. The extensive interest felt by intelligent men generally, by students of economics and by educators in this remarkable educational institution, was evidenced by the close attention of members of the club to an address lasting an hour. The speaker described the text books used by the schools, the method of teaching by mail, and answered numerous questions regarding the schools. Rev. Dr. Rose, Newark, N.J., is president of the club.

The earliest power development known to have been made at Niagara Falls was in 1750, when a small saw mill was built on the mainland opposite Goat Island by a party of French settlers. They were the pioneers in an industry which has grown to proportions unequalled at any other spot in the world. While it is highly probable that small amounts of power were utilized from that time on during succeeding years, there is no record of a substantial plan for the development of the river's force being made public until about the year 1840, when General Peter B. Porter and Augustus Porter devised a practical plan whereby man might avail himself of a portion of the river's energy. In 1847 this plan was made public through a circular, and in general the plan outlined was very similar to that now used by the Niagara Falls Hydraulic Power and Manufacturing Company.

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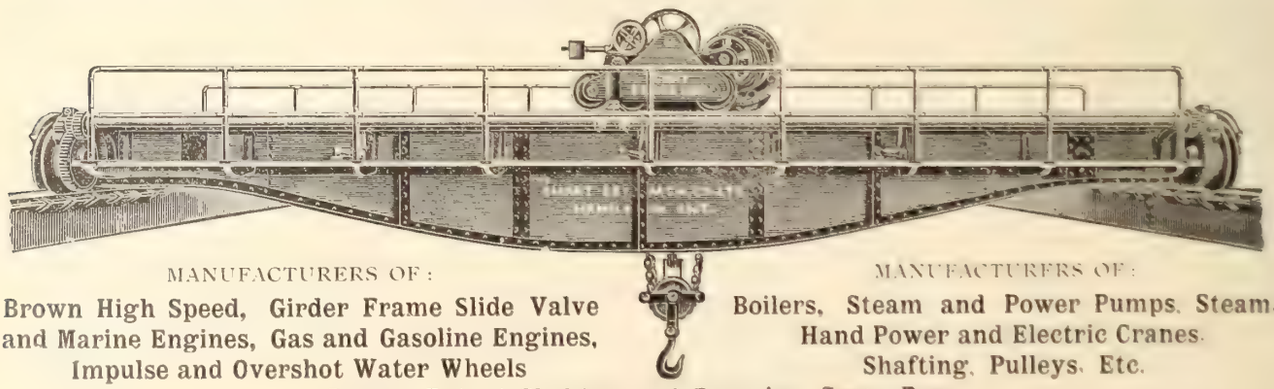


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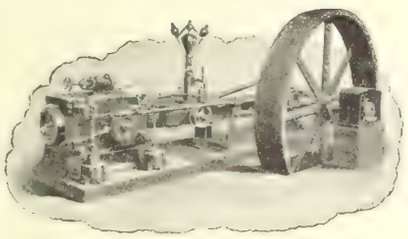
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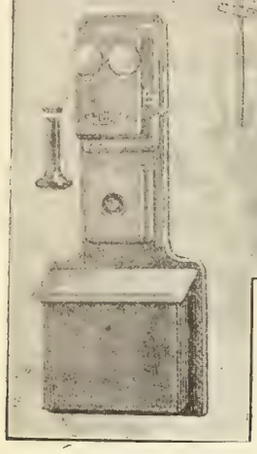
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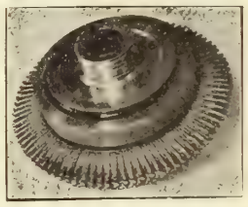
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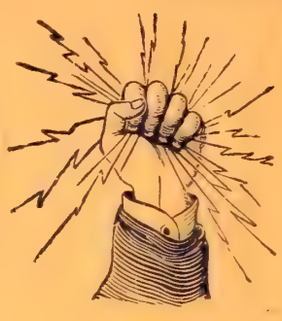
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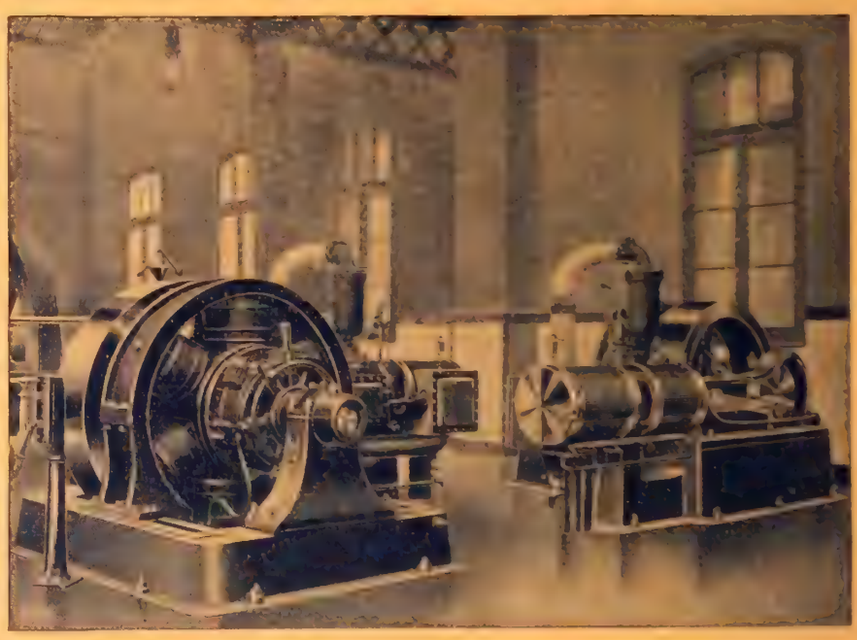
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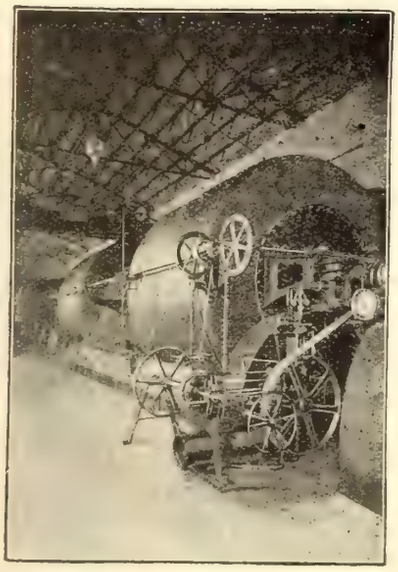
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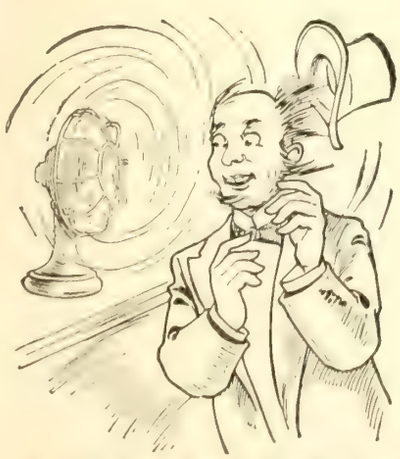
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SPARKS.

The corporation of Chatham, N.B., has taken over the electric light plant.

The work of tearing up the street railway at Moncton, N.B., is being proceeded with.

A steam plant will be installed in the new round house of the Intercolonial railway at St. John, N.B.

The electric plant of the Aylmer Electric Company, of Aylmer, Ont., will be purchased by the town.

An electric automobile has been built for the Chicoutimi Pulp Comuany, of Chicoutimi, Que., from designs by Mr. Russell, superintendent of the Quebec Railway, Light & Power Company.

A scheme is on foot to build an electric railway from Buckingham, Que., to L'Orignal Rapids, a distance of about one hundred miles. Mr. Urlic Rouville, of Paris, France, recently interviewed the Dominion Government regarding the project.

Boston and Kingston capitalists are promoting a scheme for an electric railway to radiate east and west from Kingston, Ont., and ultimately to cover the territory between Toronto and Ottawa. Mr. J. Carson is understood to be getting information regarding the available water power.

The Lardeau Light & Power Company, Limited, has submitted the details of its undertaking to the British Columbia Government. It is proposed to construct a dam across the south fork of the Lardeau river, and to erect a power station for the purpose of furnishing electric light and power to the towns of Ferguson and Trout Lake, B.C.

A new American incandescent electric lamp is made by the Phelps Company, Indianapolis. It has two filaments, and when the lamp is pushed well into the socket, the larger filament comes into action and gives a light of 16 candles; whereas, when the lamp is turned slightly, the smaller filaments light up and gives a light of only one candle.

The new plant of the Amherstburg Electric Light, Heat & Power Company, of Amherstburg, Ont., will again be in operation at an early date. The contract was let to Thomas Muir & Son to erect the power house, a brick structure 36x36 feet, with a brick chimney 72 feet hi they getting the Goldie & McCulloch Company, of Galt, to overhaul the engine and machinery. The old boiler was replaced by a new one of 100 h.p., supplied by E. Leonard & Sons, of London, Ont., and a new 1,500 light, Warren alternator is being installed. The entire reconstruction will cost about $4,200.

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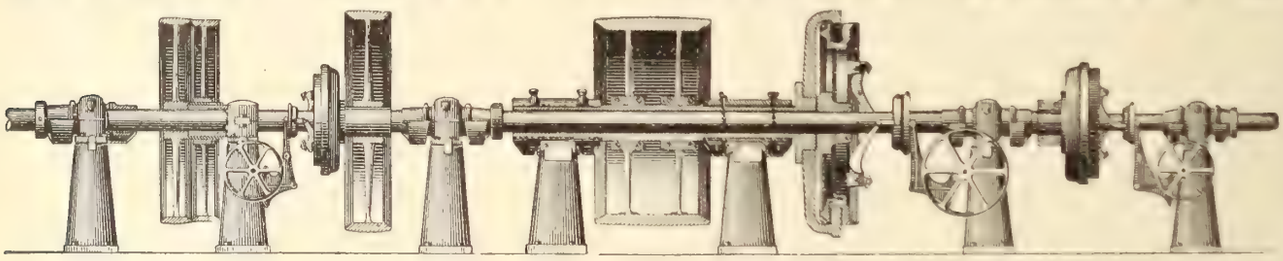
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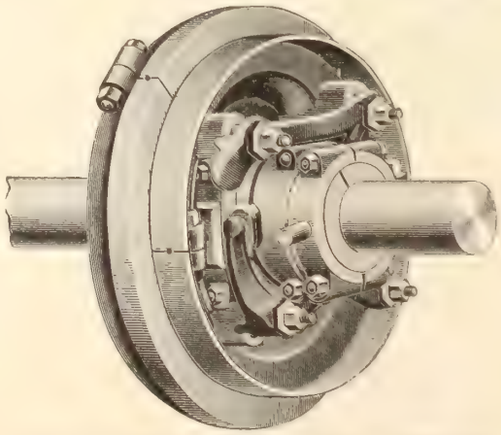
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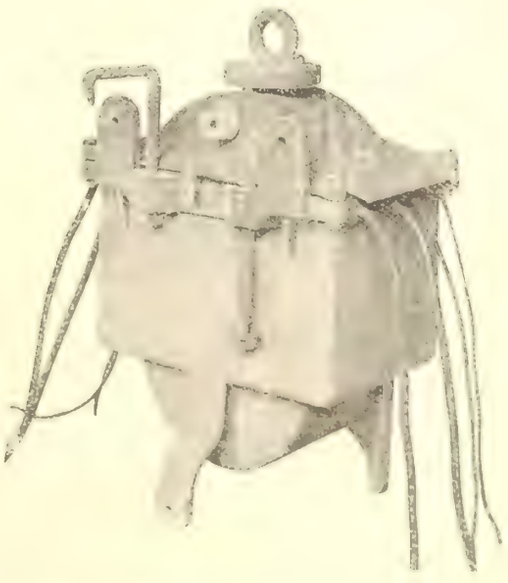
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The town council of Listowel, Ont., have made an agreement with the Listowel Gas & Electric Light Company, whereby the corporation grants to the company a franchise for a period of six and one-half years from June 1, 1901. The price to be paid for light is $45.48 for each arc lamp per year, burning 300 nights in the year, from sunset to midnight. They must be of a nominal 2,000 candle power.

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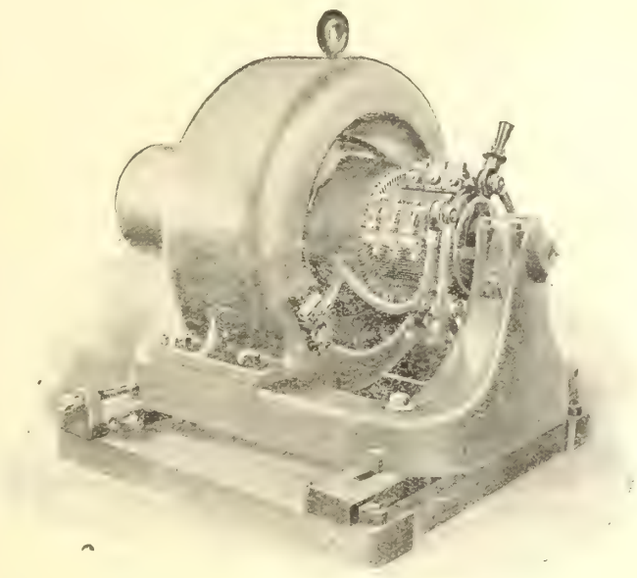
The town council of Portage La Prairie, Man., are looking into the question of taking over the electric light plant.

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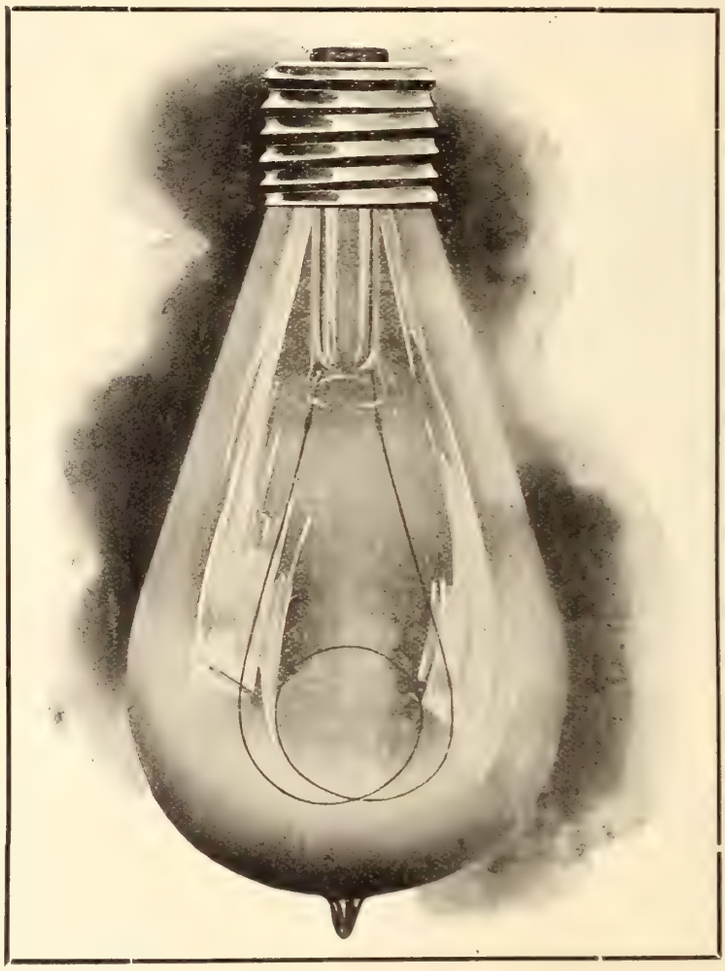
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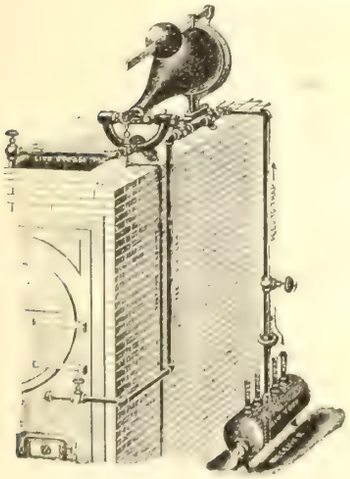
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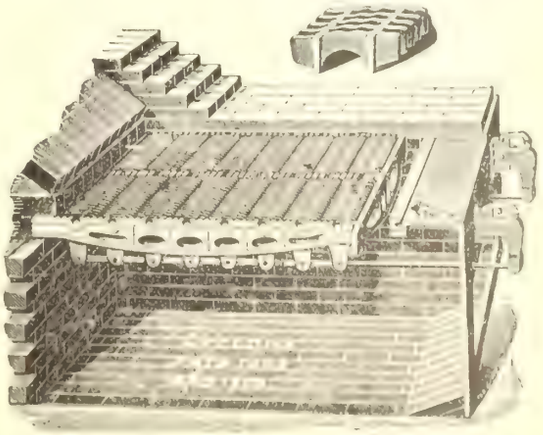
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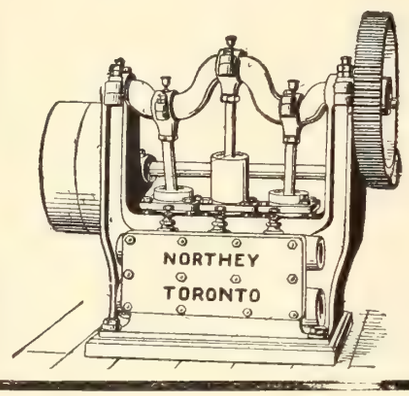
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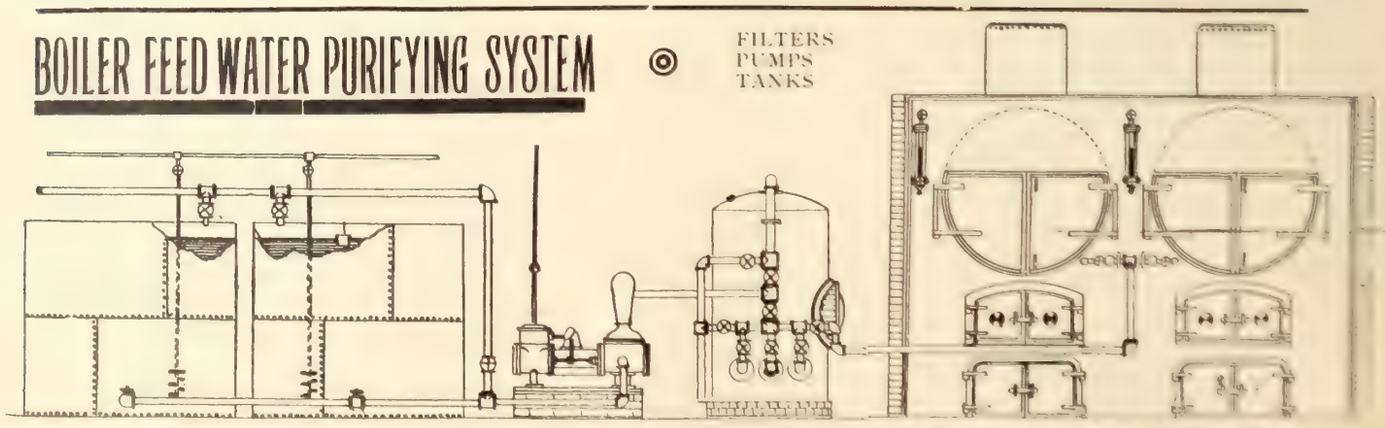
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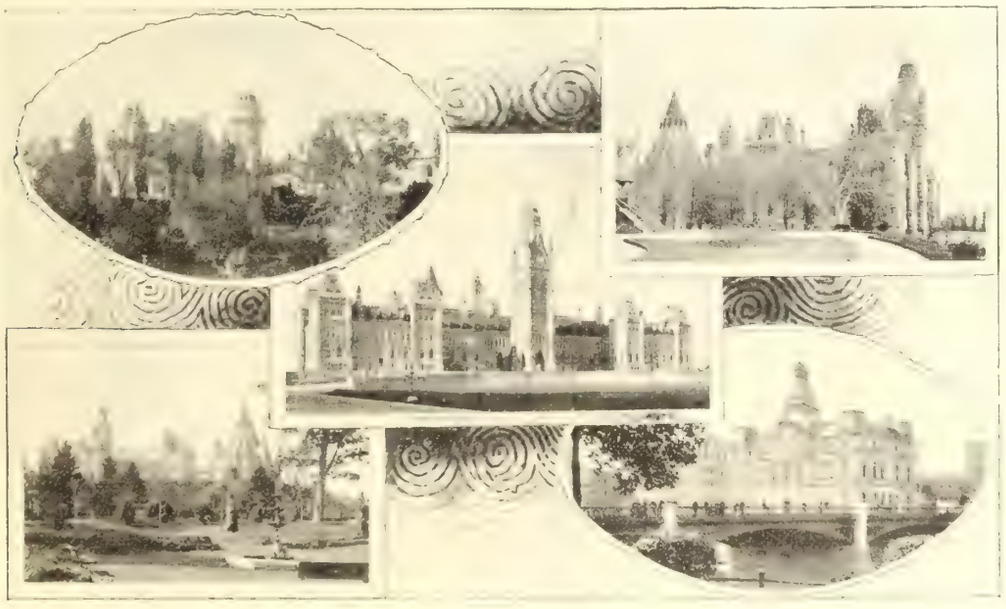
CANADIAN
ELECTRICAL NEWS
AND
ENGINEERING JOURNAL.

VOL. XI. JUNE, 1901 No 6.

Canadian Electrical Association Convention

Ottawa, June 19th to 21st.

The forthcoming convention of the Canadian Electrical Association, to be held in Ottawa, should be attended by evèry member and person interested in electrical progress. It promises to be both profitable and pleasurable, and should easily establish itself as the banner convention of the Association. Nature must have anticipated such a gathering, for she has dealt out to the Capital city with lavish hand that which will make it interesting at once to the practical electrician and pleasure seeker. No where else on the continent can such a happy blend be found. Electrical development in and about the city of Senators has given it a prominence second only to that centering on its stately Parliament Hill, with its crown of imposing legislative chambers. The convention should be attended, no matter what the expense of time or money, as it is found to be brimful of practical pointers and pleasurable features.



VIEWS OF PARLIAMENT BUILDINGS AND POST-OFFICE, OTTAWA.

To see is to appreciate, and cold type and illustrations can only give an odor of the essence of education and enjoyment in store for the wise electrician who makes the professional pilgrimage to his Capital City. Anyone of the score of attractions are alone worthy of a visit. The electric plants in and about the city should offer sufficient inducement, but the other sight-seers' magnets are bound to make the visit one of profitable pleasure.

Every effort is being put forth by President Dion and his fellow electricians to make the convention a book mark in the pages of the Association's history. To every visitor who hies himself to the annual re-union, is extended the freedom of the Capital, which has a history not the least of its interesting features. Beneath the shadows of Parliament Hill can be studied the passing ages of Canadian history arrested as it were for the visitor's eyè. The locks of the Rideau Canal, Col. By's master piece, massive, quaint and grey with age, speak of the early days of the nineteenth century. Within view, the graceful lines of the new Interprovincial bridge tell of the opening days of the twentieth century. Contrast pleasing and interesting meets the eye on every side. A volume could in short be written on Ottawa, and still the tale would be but half told. Its University, Normal School, Convents and other seats of learning, the imposing French Cathedral, and friendly front of Christ Church Cathedral, its numerous beautiful churches and private residences, Rideau Hall, the home of the Governor-General, the stately Parliament Buildings, with their wealth of architectural beauty, all make it a city wherein the eye is pleased and the mind elevated. Its quaint and picturesque river scenes, bustling lumbering, electrical and manufacturing industries, the long lines of progressive, prosperous business and residental streets, the many delightful suburban haunts, . its natural beauty must all be visited and studied if the Canadian is to truthfully say that he knows his own country. The electrician must visit the many centers of electrical energy in and about Ottawa if he is to say that he has seen the very latest appliances and equipments in his own special sphere.

The disastrous fire fourteen months ago made necessary the postponement of the convention, which was transferred last year to Kingston. Although Ottawa and Hull are

both building up well, the swath of the fire is still easily discerned, furnishing a vista of ruin seldom equalled in the history of the world's cities. With the energy characteristic of the Ottawan, the city has recovered itself and the latch key hangs in an inviting position for the convention visitor. The variety of attractions offered the visitor by Ottawa rivals those of the Old World's Capitals. A study of the accompanying illustrations will bear out this assertion.

The member of the Canadian Electrical Association who turns a deaf ear to his Capital's invitation, will not fail to hear of his folly when his more enterprising friends return.



Wellington Street, Ottawa, from Parliament Hill.



The New Interprovincial Bridge across the Ottawa River.



View of Rideau Street, Ottawa.

THE OTTAWA ELECTRIC COMPANY.

The Ottawa Electric Company was established in 1894, and is the fruit of the amalgamation of the three electric companies then in existence, viz., Chaudiere Electric Light & Power Company, Limited, the Standard Electric Company, Limited, and the Ottawa Electric Light Company. The present company supplies incandescent and arc lighting and power to Ottawa and vicinity. It has shown great energy in the extension of its system, and now reaches all parts of the city and suburbs, covering almost every street. In addition to the city contract for street lighting, which calls for 442 arc lights, the company supplies its private customers with 225 arc lights. The installation of incandescent lights is 100,000, over one and a half lights per head of population.

The company does not supply power in very large units, but operates some 300 motors, varying from a half to 50 h.p. Before the fire on April 26th last, the company had six different power houses, but four of them were destroyed on that memorable day. Since then the company has shown wonderful energy in getting its service under way by establishing temporary stations which will be used until the re-construction of the permanent plants.

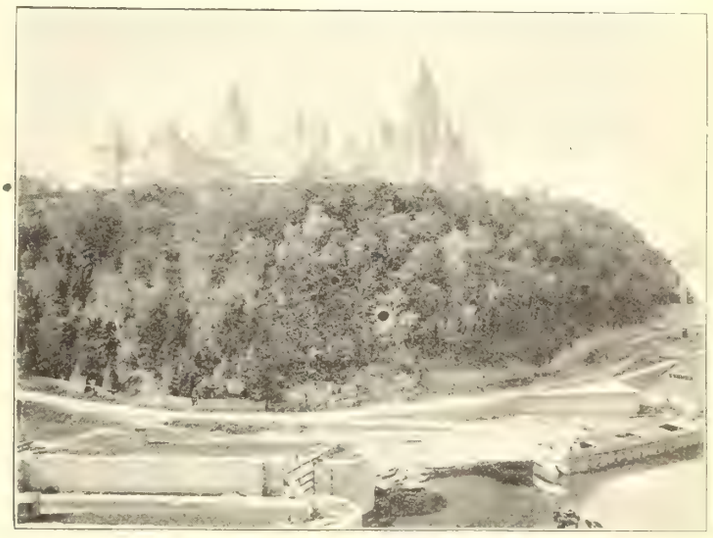
The company took advantage of this forced re-construction to make such alterations in its system as would bring it up to the most exacting modern requirements. On the site of one of the old power houses, the company is



View of City from Rideau Falls.



Senate Chambers, Parliament Buildings.



View from Foot of Rideau Locks.



Nepean Point and Printing Bureau.

VIEWS OF OTTAWA AND VICINITY.

building a large hydraulic station. The two stations, one hydraulic and one steam reserve, which escaped the fire, are to be remodelled. The current generated in these three stations will be united in a distributing station up town, from which wires for all services will radiate.

The new station under construction will be absolutely fire-proof, being built of concrete, brick and iron. From the bulk heads at the intake, the water will be carried



OTTAWA ELECTRIC COMPANY—EXTERIOR STEAM STATION, BRITANNIA STREET.

through a wooden box flume for 200 feet into a large pond, surrounded by heavy concrete walls. From this pond, it will pass through an iron rack into the flumes of the several wheels, to afterwards discharge through tubular iron draught tubes into a tail race cut out of the solid rock. This tail race will be about 30 feet in width, extending about 200 feet and discharging into the Ottawa river at a point about 1,000 yards below the Chaudiere Falls. The plant in this station will consist of three sets of horizontal water wheels made by the Stillwell Bierce & Smith Vaile Company, of Dayton, Ohio, direct connected to Westinghouse generators. Each unit will consist of three 39-inch wheels, two with central discharge and one with quarter turn, operating at a speed of 143 r. p. m. under 25 feet head. The wheel cases will be submerged in the flumes, the draught tubes being built in the floor. The



OTTAWA ELECTRIC COMPANY EXTERIOR OLD HYDRAULIC STATION, AMELIA ISLAND.

generators will be of 700 k.w. capacity, two phase, 60 cycles, 2,200 volts. Extra flumes, draught tubes, etc., are to be provided, so that additional units can be installed any time without much trouble.

Two Westinghouse exciters, each 56 and a half k.w. and capable of supplying alone the fields of all the generators in the station, will be direct connected, each to a pair of 15-inch wheels, running at 475 r. p. m. Provision will be made against the possibility of such small wheels choking with frazil by means of pulleys placed on the adjoining main wheel shafts, from which the exciters may be driven when required. The water wheels will be governed by Lombard governors. A 20 ton travelling crane is being provided for handling machinery in this station. The building will be 150 feet long by 45 feet wide.

The old hydraulic station which escaped the fire, will be remodelled by discarding a number of small generators, both direct and alternating current, and a mass of shafting, pulleys, etc., and installing in their stead two generators similar to those in the new station, except that they will be belted to the jack-shaft of the water wheels and run at 375 r. p. m. The latter are vertical and bevelled geared. Provision will also be made for the installation of a third unit later. This building is a substantial stone structure, 145x50 feet and two storeys high, with flat gravel roof. The head of water at this station is 22 feet.

The steam power house, which contains two Wheelock engines of 500 h.p. each, tandem compound and condensing, will be re-arranged by changing the generators therein for two of the same type as in the other stations, but of 225 k.w. each. There is also in this station a 500 volt D. C. generator which is kept in reserve to help the street rail-



OTTAWA ELECTRIC COMPANY—NEW HYDRAULIC WORKS AND STATION IN COURSE OF CONSTRUCTION.

way company or the D.C. motor system of this company in case of any breakdown elsewhere.

The sub-station will contain, besides extensive marble switch-boards for the distribution of the different classes of service, a 300 k.w. rotary converter, supplying 250 and 500 volts D.C. motor service on a three wire system for motors already installed, elevators and places where it may not be desirable to use A. C. two phase motors. A storage battery of 400 ampere hours capacity will relieve the "Rotary" during the peak af the load. There will also be three units, each composed of a 350 h.p. induction motor direct connected to two Western Electric multi-circuit arc machines, giving a capacity of 300 enclosed arc lamps per unit. Adams Bagnall arc lamps will be used.

The sub-station is to be a substantial brick building, and will contain besides the above, quarters for line men



OTTAWA ELECTRIC COMPANY SWITCH BOARD IN POWER HOUSE NO. 1.

and wire men. There will also be accommodation for line men's stores, workshop, meter department, etc.

The company occupies handsome and commodious offices on Sparks Street near the Russell. The officers of the Ottawa Electric Company are as follows: President, T. Ahearn; Vice President, F. P. Brennan; General Superintendent, A. A. Dion; Secretary-Treasurer, D. R. Street; Superintendent of Power Houses, John Murphy; Superintendent of Construction, W. G. Bradley; Hydraulic Engineer, W. H. Baldwin; Steam Engineer, George Scott.

Mr. A. A. Dion, General Superintendent of the Ottawa Electric Company, is probably best known to his colleagues throughout Canada in his official capacity as President of the Canadian Electrical Association. Mr. Dion has been engaged in the electrical business in various positions for 12 years, having occupied his present position since the formation of the company in 1894. He is a member of the American Institute of Electrical Engineers and the Canadian Society of Civil Engineers. He is energetic, affable and thoroughly versed in all the details of the work. Capt. D. R. Street, Secretary-Treasurer of the Ottawa Electric Company, was treasurer of the Chaudiere Electric Company for three years prior to the amalgamation. He was then appointed Chief Accountant of the Ottawa Electric Company, and in 1895 entered upon his present responsible position. Capt. Street holds a commission in the Governor-General's Foot Guards, one of Ottawa's crack regiments. His enthusiasm in military matters and popularity in the city are both of a high voltage. Mr. John Murphy, Superintendent of Power Houses for the Ottawa Electric Co., is a young man for the position, but one well qualified if judged by the de ree of excellency which the system has attained, despite the serious set-back given by the fire of April 26th, 1900. Mr. Murphy is a graduate of the University of Ottawa. While at that University he paid special attention to the study of electricity. He was first connected with the local office of the Bell Telephone Company, and afterwards accepted charge of an electric plant at Chelsea, one of first installed in the vicinity of Ottawa. Mr. Murphy was afterwards connected with the Chaudiere Light & Power Company, and on the amalgamation with the present company, he assumed the position he now holds. He was recently admitted into full membership in the American Institute of Electrical Engineers, a distinction and recognition of merit.



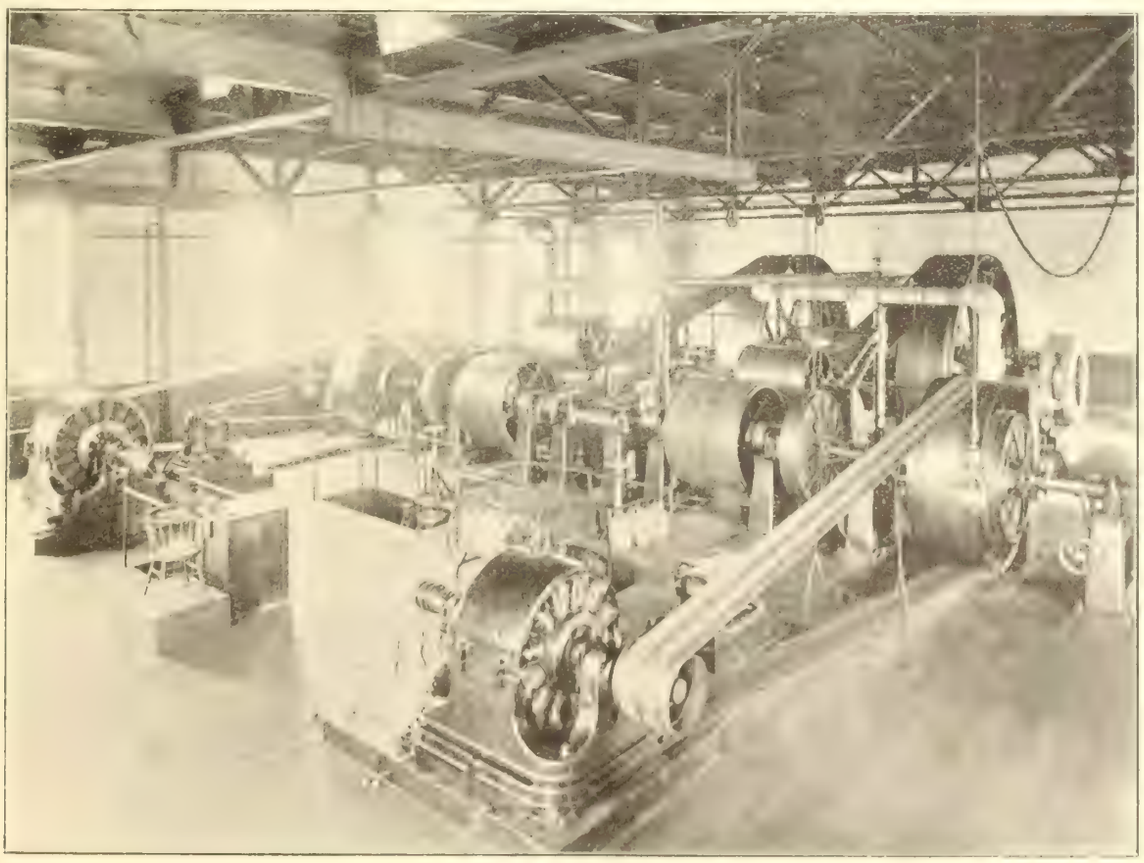
MR. A. A. DION,
Superintendent Ottawa Electric Company, and President C. E. A.



CAPT. D. R. STREET,
Secretary-Treasurer Ottawa Electric Company.



MR. JOHN MURPHY,
Superintendent of Powe House, Ottawa Electric Company.



OTTAWA ELECTRIC COMPANY—INTERIOR STEAM STATION, BRITANNIA STREET



CHATS RAPIDS ON OTTAWA RIVER.



SCENE IN QUEEN'S PARK, AYLMER.



WATER CHUTE, QUEEN'S PARK, AYLMER, HULL ELECTRIC RAILWAY.



RIDEAU FALLS AT JUNCTION OF OTTAWA AND RIDEAU RIVERS.



CHAUDIERE FALLS.

VIEWS OF OTTAWA AND VICINITY.

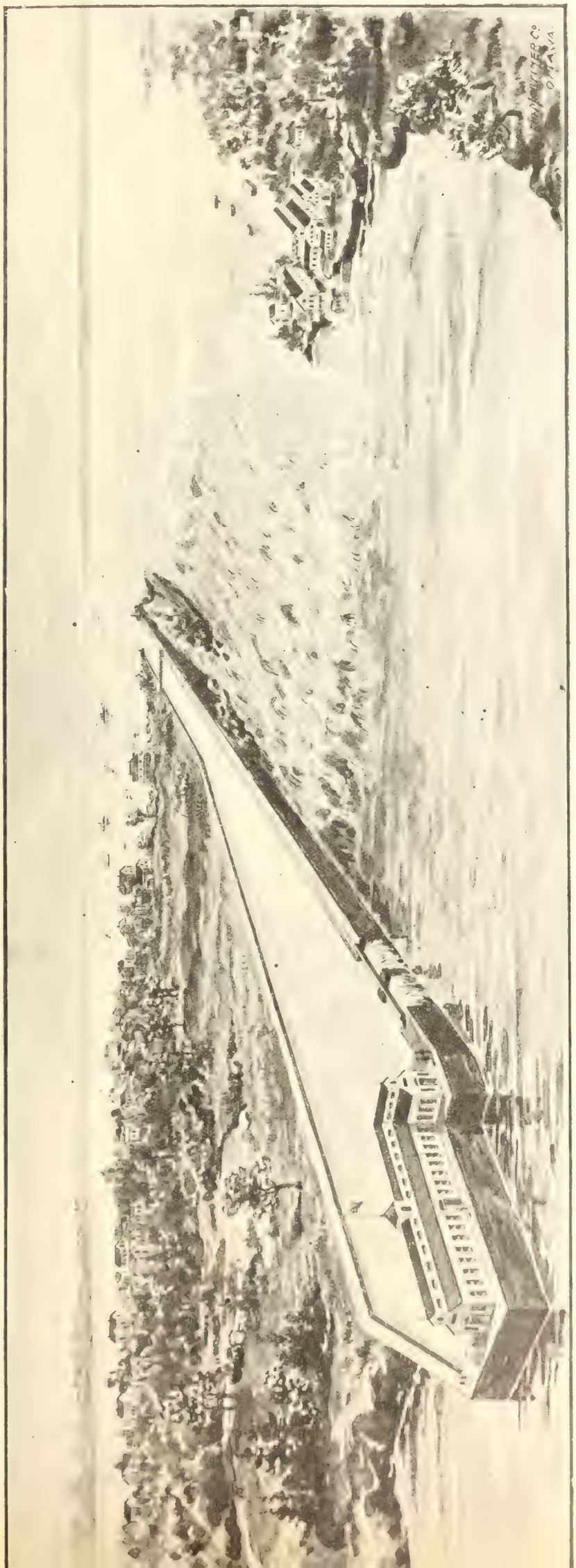
METROPOLITAN ELECTRICAL COMPANY.

The delegatès to the forthcoming convention will find in the Metropolitan Electric Company's works a striking illustration of the great strides made in the development of electrical power in the vicinity of Ottawa. The scene of operations is at Britannia, situated on the Ontario side of the Ottawa river about five miles from the Capital. Here are the Deschene Rapids, famous as a fountain head for the development of electrical energy. This water power at a comparatively small outlay can produce 20,000 horse power. It is to be taken by canal from still water at the head of Deschene Rapids, to still water at the foot; the fall in the water level being about ten feet. For thirty miles above, the current is hardly noticeable. The river is from one and a half to four miles wide, and very deep. The present canal, which is practically completed, has a length of 3,000 feet. At the mouth where the water is thirty feet in depth, it has a width of 240 feet. The narrowest part is 150 feet, and at the lower end the canal is 450 feet wide. Hence with a fall of ten feet, according to plans, it will be easy to develop 5,000 h.p. in this canal. The canal is cut in the solid rock for about one-half the distance from the mouth end. The inside wall for the balance of the distance is made from clay, riff raffed with rock taken out of the excavation. The outside wall is made of crib work. Work will shortly be started on the power house, which will be situated at the east end of the canal. The scene of the Metropolitan Company's operations were visited a year ago by the leading civil and èlectrical engineers of Canada, who were in attendance at the annual convention. They one and all when viewed by reporters, expressed themselves as having every covfidence in the future of the company. The power developed, they stated, will prove constant and adequate under all circumstances and conditions.

On this occasion, Prof. Bovey, of McGill University, Mr. E. P. Hanniford, Mr. Robert Forsythe, Mr. C. B. Leprohon, Mr. William Kennedy, of Montreal, Mr. Robert McCall, Provincial Engineer of Nova Scotia, Mr. C. H. Mitchell, of Niagara Falls, Mr. E. H. Keating, of Toronto, and other equally prominent engineers assured the people of Ottawa through the local papers, that there is no probability of this power being impaired by anchor ice, and that it must prove an important factor in the industrial development of the city.

Prof. R. B. Owens, of McGill University, and Mr. C. K. Green, engineer of the Cataract Power Company, of Hamilton, have made special reports on this power to the same effect.

Nature assisted by man has solved the vexatious anchor ice problem for the Metropolitan Company. Where



CANAL AND POWER HOUSE, METROPOLITAN ELECTRICAL COMPANY.

there is still water for thirty miles, as above the power house, it freezes over and prevents the formation of anchor ice. Below the power house the river is frozen for a distance of three miles, and the water is very deep.

The Metropolitan Electrical Company has an advantage inasmuch as it has a constant supply of still water above the power house. It can thus be seen that the Metropolitan Company has an electrical power absolutely free from anchor ice, which is such a detriment to many electrical companies.

Power will be transmitted to Ottawa for lighting and manufacturing purposes, by means of transmission wires five miles long. The property at Britannia consists of 160 acres, so that there is ample accommodation for large manufacturers. The development of the power has been a great work, and the citizens of Ottawa and suburbs have abundant faith in its ability to bring increased industrial prosperity. The city council, as an evidence of this faith, granted the company a franchise which gives it power until 1923 to deliver and distribute electric power within the city limits for lighting and manufacturing purposes. It has thus a wide field, as the demand for and the use of electricity in the rapidly growing city is increasing at a great rate as the years pass by. The city has a population of over 85,000 within three miles of the city hall It is served by eight lines of railway and hence should with the extra and effective advantage of cheap power, soon become one of the leading manufacturing centers.

The officers of the Metropolitan Electrical Company are as follows: President, Thomas Lindsay, merchant, Ottawa; Vice-Presidents, W. Arnold, Ottawa, and Charles Jenkins, Petrolia; Secretary-Treasurer, George A. Wanless, Ottawa; Directors, John Flett, Toronto, Arthur B. Broderick, Ottawa, Fred C. Cairs, Montreal, and Edgar S. Reid, Toronto.

Mr. Lindsay, President of the company, though a comparatively young man, occupies a prominent position in the business field in Ottawa. He has outstripped many of his older competitors and is looked on as one of the shrewdest and most successful of Ottawa's merchants. He is head of the well known firms of T. Lindsay & Company and Larose & Company, conducting departmental stores on Wellington and Rideau streets. The list of shareholders includes many of Canada's leading financiers and business and professional men.

The Metropolitan works can be reached from the heart of the city by the Ottawa Electric Railway surburban line to Britannia on the bay.



MR. THOMAS LINDSAY, PRESIDENT METROPOLITAN ELECTRICAL COMPANY.

OTTAWA ELECTRIC RAILWAY.

It is the proud boast of the people of Ottawa that their street railway system stands second to none in America, both in point of equipment and operation. The citizens take a great interest in this road; when an Ottawa man goes abroad he forms his opinion of a street car service by comparing it to that of his native place as a standard of excellence. The street railway interests of Ottawa are controlled by one company. The cars are operated entirely by electricity by the overhead trolley system, and the service is beyond question a good one, the road-bed is smooth and the cars are roomy and comfortable. The cars are pleasantly heated in winter by electric heaters concealed under the seats. They are kept neat and clean, and the conductors and motormen are well dressed and well disciplined. The cars go everywhere and everybody rides.

The Ottawa Electric Railway Company is not an old corporation. In 1890 the city council granted Messrs. Ahearn and Soper a franchise for operating an electric road. They organized the Ottawa Electric Street Railway Company, which was incorporated early in 1891 with an authorized capital stock of $1,[illegible] and in the [illegible] that year the road was opened for traffic. The Ottawa City Passenger Railway Company, incorporated in 1886, had been in operation since 1870. In 1891 these two

companies joined hands, adopting the name which they now carry; they hold a Dominion charter, and it is the only street railway company in Canada having this. The present paid up stock of the company is $814,000, with no bonds or other indebtedness standing. The officers are: T. Ahearn, president; P. Whelen, vice-president; J. D. Fraser, secretary-treasurer, and J. E. Hutchinson, superintendent. The directors are T. Ahearn, P. Whelen, W. Y. Soper, A. Lumsden, G. P. Brophy, Hon. G. A. Cox, and J. Workman.

The company is working under an agreement with the city of Ottawa for a term of thirty years from August 13th, 1893, whereby it pays the city an annual stipulation of $450 per mile of street covered by its tracks during the fifteen years of its agreement, and $500 per mile during the balance of its term; it is not required to pay the city a percentage of its receipts and is exempt from all taxes, except on real estate. Further, the company agrees to remove all snow from the streets occupied by its tracks, and the city keeps the streets permanently in repair.

The motive power used is entirely a water power, the plant being located on Victoria Island, at the Chaudière Falls, where a head of nineteen feet is secured. The power house is the most modern and up-to-date in every particular in this part of Canada. The building is absolutely fire-proof, being built almost entirely of concrete and steel. The water wheels are all connected to the generator by one shaft 90 feet long and about 15 inches in diameter. The draft tubes go down ten feet and are eight and



MR. J. D. FRASER,
Secretary-Treasurer Ottawa Electric Railway Company.

one-half inches in diameter. The six horizontal water wheels being connected by one shaft do away with all pinions, bearings, etc. The water wheels were manufactured by the Stillwell-Bierce & Smith-Vaile Company, of Dayton, Ohio, and supply power for an 1,800 horse power plant. The dynamo is capable of generating 1,700 horse power. It was manufactured especially for Ahearn & Soper by the Westinghouse Company, of Pittsburg, Pa. The width, when open, or rather when the fields are parted, is 155 1-2 inches. The dynamo weighs one hundred and five tons; the armature alone is eight feet in diameter and weighs 27 tons.

The road extends over twenty-five miles of streets, nearly all of it being double-tracked. There are forty-five miles of track; 40 lb. T rails were used at first, but in all later work 52 lb. girder and 72 lb. high T rails were put down on the main business streets, and 56 lb. T rails on the out-lying districts. Ties are set 2 feet 6 inches between centres and angle fish plates are used. Bonding is done with No. 00 copper wire, cross bonded every 200 feet and connected at intervals to the water mains; where the tracks pass the power house six No. 0000 copper wires are taken from the rails to the negative leads on the station switch-board. A point worthy of note is that trouble with telephone interference has been fully avoided by putting up a large number of copper aerial return wires in addition to the ordinary returns. These lines are distributed to tap the rails at different points of the city, and vary in size from No. 0000 to No. 2. No. 00 hard drawn trolley wire is generally used, though No. 000



MR. G. W. LANG,
Inspector Ottawa Electric Railway Company.

figure 8 is being put up on new work. The lines are well supplied with feeders and the available potential is practically the same at all points.

The rolling stock consists of fifty-eight closed vestibule cars, forty-one open cars, one locomotive, and seven sweepers. The first cars used were built by Patterson & Corbin, of St. Catharines, Ont.; all later ones are of the Ottawa Car Company's make. Westinghouse double equipments are used throughout. Each car is thus fitted with two 30 h.p. motors. The Providence car fender is the one in use.

The company claims the honor of successfully getting rid of the snow, and Ottawa has a superabundance of that commodity. When snow begins to fall, the sweepers are put out immediately; these are followed by the "Walk-away" snow ploughs which shove the snow to the side of the roadway. It is then carted away by horses. Since the road has been in operation, not a single trip has been lost on this account. The car sheds, of which there are five, are located on Albert street and New Edinburgh, each building being 66x100 feet, built of brick with iron trussed roofs. The repair shops and a very commodious



MR. R. INGRAM,
Inspector Ottawa Electric Railway Company.

suite of offices are situated in one of these buildings, that on Albert street.

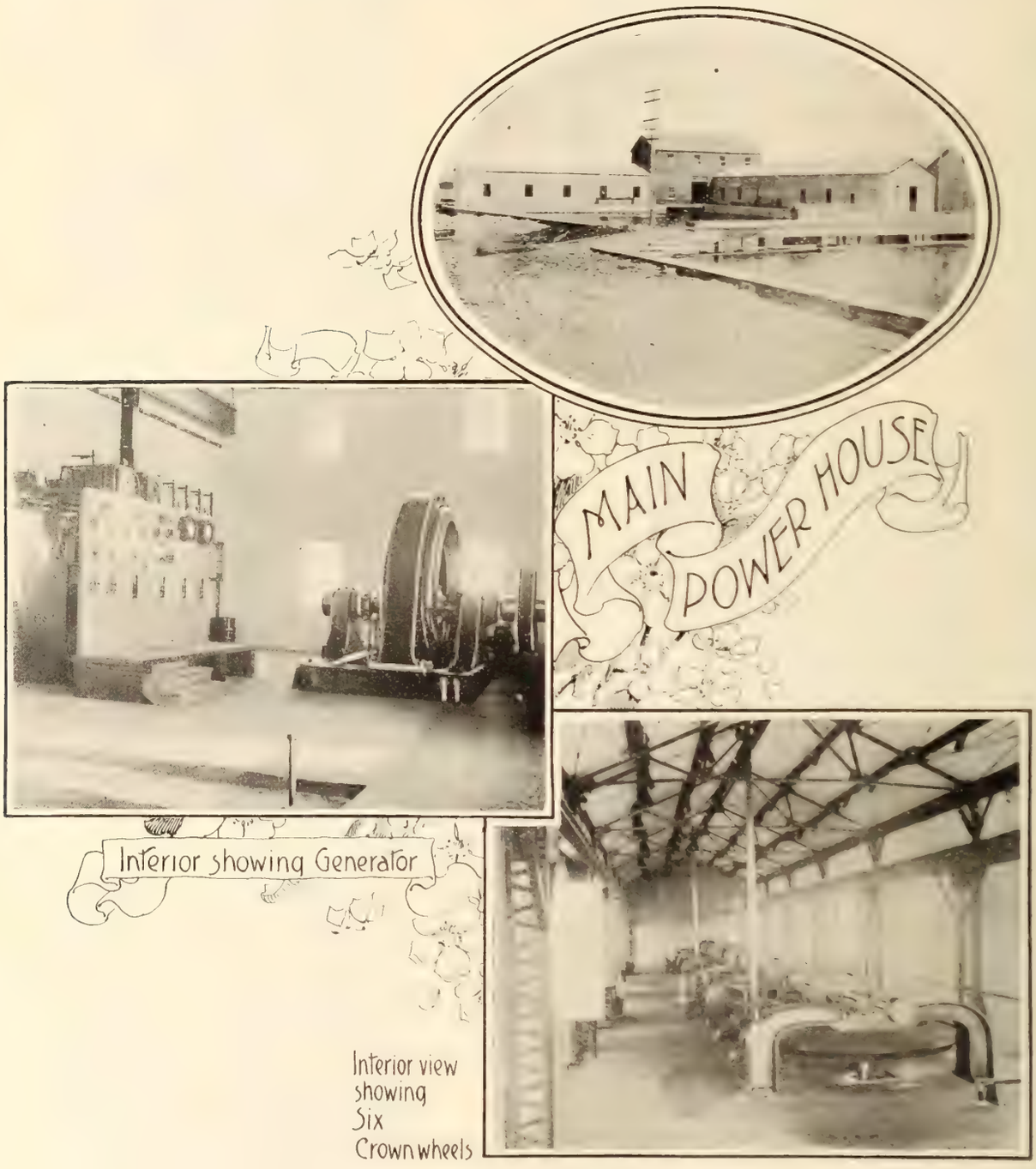
The company transports all mail matter between the post office and railway depots, and carries the letter carriers under agreement with the Dominion Government.

The service was begun in October, 1893, and was the first of its kind on this continent, as is now well known.

Rockliffe Park is a most delightful place for recreation, situated as it is among primeval pines on the high bank of the Ottawa river, on the Ontario side, about three miles below the main part of the city. From Rideau Hall outward the railway company has a private roadway winding through beautiful woods along the bank of the river. The company has been running this park as a pleasure ground, and finds it a fruitful source of revenue. The private roadway and the park are brilliantly lighted by arc and incandescent lights supplied with current from the railway circuit.

Britannia-on-the-Bay, about five miles from Ottawa, on the other shore of Lake Deschene, is an ideal summer resort. The view along the Britannia line, running between the highway and river bank, is pleasing and picturesque. At night the line is brilliantly lighted by incandescent lights. One of the chief attractions is the stone promenade pier running one thousand feet out into the lake, at the end of which is a breakwater one hundred feet long and twenty feet wide. Here band concerts are held throughout the season. The beach is a beautiful sandy one, suitable for bathing. Last summer the company extended its double tracks from Rockliffe park to the new Government Rifle Range, a distance of two miles. This is a beautiful run, the line being built on the brow of the cliff. The scenery is magnificent. The Dominion Rifle Association meeting is held here every summer. Each week the local riflemen also practice at the targets.

J. E. Hutchison, superintendent of the Ottawa Electric Railway, was first connected with the Canadian Pacific Railway, in various capacities, attaining the position of train-master. He is a popular official and is credited with much of the success the Ottawa Electric Railway has attained. Capt. Hutchison is an officer with 3rd Regiment Ottawa and Carleton Rifles and is one of Canada's crack shots. Mr. J. D. Fraser, secretary-treasurer, assumed the position in 1882 of secretary of the Ottawa City Passenger Railway Company. He accepted a similar position with the Ottawa Electric Railway Company in 1891, continuing after the amalgamation of the two companies in 1893 in his present responsible position. A search of the continent could hardly have located a better man for the position, at least this is the opinion of Mr. Fraser's many friends and thousands of fellow citizens. Mr. R. Ingram and Mr. G. W. Lang, Inspectors, hold positions in which the exercise of tact and judgment is an hourly requisite. Both gentlemen possess these keynotes to successful business management, and it is large



VIEWS OF THE CAPITAL POWER COMPANY.

due to their untiring efforts that the Ottawa Electric Railway has attained its present favorable position.

THE CAPITAL POWER COMPANY.

The Capital Power Company, Limited, is one of the latest and most energetic factors in the development of electrical energy in the vicinity of Ottawa. This enterprising concern secured the rights to and possession of the water lots owned by R. & W. Conroy at Deschenes. The latter firm operated a large saw mill by means of the water power, but this industry was wiped out by fire two years ago. Power is secured from the Deschene Rapids, situated on the Ottawa river, about five miles above the Chaudiere Falls. The plant is installed on the north or Quebec side of the river directly opposite the Metropolitan Power Company's scene of operations.

There is 9 feet head of water. In all 11 turbines have been installed, each of which at low water gives 228 h.p. or a total of 2508 h.p. The six wheels at present in operation are controlled by two Woodward governors. The turbines are of the vertical type, measuring 61 inches. The power is transmitted to the jack-shafts by Leffel wheels, the generator being placed on its shaft. There are two 880 k.w. generators, producing 2133 h. p. A second generator will be installed shortly. The direct connection of the generator with the shaft does away with belting. This power is transmitted a distance of five miles, by wire to Hull, where 1,500 h.p. is utilized by the E. B. Eddy Company, and 200 h.p. by the Matthews Packing Company. The alternating current is used at a voltage of 10,000 volts, which is transformed to 440 volts at the Eddy Company's mills and 550 volts at the Matthews Company's factory. The transmission line to Hull is in two sections, of three wires each. The power will be used mainly for manufacturing purposes in Hull. It is leased at from $15 to $25 per h.p. according to quantity.

Building operations were commenced in the spring of 1900. The flumes are good examples of low head development in concrete. The superstructure is entirely fireproof, it being probably one of the first electrical power houses in which the fire risk has been reduced to a minimum. As such it is worthy of the inspection of the visitors.

The generating house is built of brick, with concrete floor and iron roof lined with asbestos mill board. The two hydraulic power houses are constructed of iron, with expanded metal cement walls. The roof is built of corrugated iron. The plans have been so arranged that the capacity of the power house may be doubled.

Mr. R. J. Devlin, merchant of Ottawa, is president of



the Capital Power Company and chairman of the Board of Directors. Mr. Louis Simpson is managing director. Mr. J. M. Shanley is the Engineer in Chief.

Mr. Louis Simpson, managing director, was formerly general manager of the Montreal Cotton Company. He is a gentleman of experience and energy, and is thoroughly familiar with the electrical field. He states that he is preparing to develop the immense water power at the Chats Rapids, on the Ottawa river, 28 miles above the city, and that work will be shortly commenced by an English company, which will develop the power for manufacturing purposes. The Chats Rapids are reached by boat from Aylmer. Deschenes, the scene of the Capital Power Company's operations, is situated between Hull and Aylmer, on the line of the electric road. A visit to the plant will in all probability be arranged for during the convention.

AHEARN & SOPER.

The history of the above firm gives the key-note to the history of electrical development in Ottawa. The members of the firm are Mr. Thomas Ahearn and Mr. Warren Y. Soper, both prominently identified with the progress of the Capital, as successful promoters of its leading electrical enterprises. The firm is well known throughout the Dominion, it having for many years past been



MR. LEWIS SIMPSON,
Manager Capital Power Company

Canadian representatives of the Westinghouse Electric & Manufacturing Company of Pittsburg. Ahearn & Soper have installed many extensive plants in various towns and cities. The members of the firm are pioneers in electrical development in Ottawa. They established the Chaudiere Light & Power Company in 1886, and were the first to introduce incandescent lighting in Ottawa. In 1890 they organized the Ottawa Electric Railway Company, the road being opened for traffic in June, 1891. They were the first to demonstrate the practicability of operating an electric system during the frigid and fleecy reign of Our Lady of the Snows. The members of the firm are also identified with the Ottawa Electric Company and Ottawa Car Company.

In addition to the commodious office and show room on Sparks street, near Elgin, the firm has a factory on Albert street, adjoining the Ottawa Electric Company's car sheds, where it manufactures switch-boards and other electrical devices.

THE OTTAWA POWER COMPANY.

Situated on Victoria Island, Chaudiere, in the city of Ottawa, is the power house of the Ottawa Power Company, Limited, which is a massive stone building 40x85 feet with two penstocks covering a space about 58x70 feet. The walls of the building and penstocks are from 2 to 6 feet feet in thickness, depending upon the strength required in the different locations. The floor and ceiling are made of expanded metal and concrete, the roof of corrugated galvanized iron covering steel rafters. The structure is therefore entirely fire-ptoof. Each penstock contains two pairs latest improved special 50-inch Samson double horizontal turbines, center discharge, manufactured by Jas. Leffel & Co.,



MR. T. AHEARN.

of Springfield, Ohio, planned to develop 2,000 h.p. under a 25 foot head of water. As the two units are identical the capacity of the power house is, therefore, 4,000 h.p. Each set of water wheels has direct connection upon the same horizontal shaft with two electrical machines—one 60 cycle, 44 pole, 1,500 k.w., 163 and a hali r. p. m., 2,300 volt single phase revolting field alternator, and one 38 pole, 200 k.w., 160 r. p. m., 225 volt direct current generator. Both units of electrical machinery of the above description were furnished by the Canadian General Electric Company of Peterborough, Ontario, and are used to furnish electric current and power to the factory of the Ottawa Carbide Company, Limited, a few hundred feet distant. The alternating current is used for the smelting of coke and lime in the manufacture of calcium carbide and the direct current is utilized in the running of motors which operate the crushers, elevators, convevors, etc., of the carbide factory.



MR. WARREN Y. SOPER.

The officers of the Ottawa Power Company are Hon. E. H. Bronson, president; W. C. Edwards, vice-president; and Levi Crannell, secretary-treasurer. The officers of the Ottawa Carbide Company are Hon. E. H. Bronson, president; T. L. Willson, vice-president; Levi Crannell, secretary-treasurer and F. P. Bronson, managing director.

HULL ELECTRIC RAILWAY.

The Hull Electric Railway, running from Hull along the Ottawa river to Aylmer, is possessed of unique features bound to attract the attention of electrical engineers. The road was formerly part of the C.P.R. system, connecting with the Pontiac and Pacific line at Aylmer, and the C.P.R. main line at Hull. There was then ten miles of single track. In 1896 this was secured by capitalists interested in water powers and lumber mills at Deschenes, midway on the line. The equipment of the road for electric traction was planned and plannèd successfully. A second parallel track and sidings were laid down, mal 26 miles of track in all. The double tracked line was ted up as a summer resort. A summer hotel, the "Victoria," was also built midway between Aylmer and th: extended through Aylmer to Queen's Park, which was fitpark.



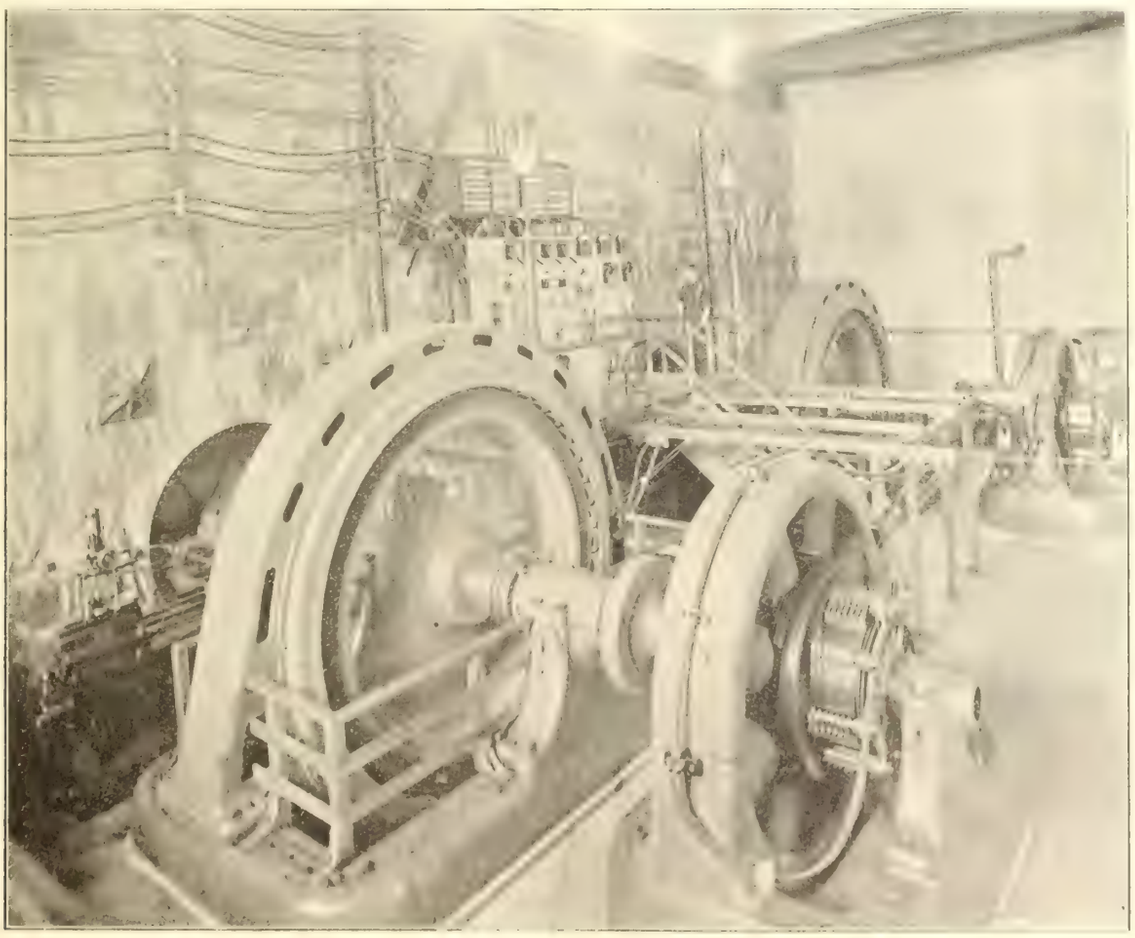
Ottawa Power Company Power House.



Ottawa Power Company Pond and Power House.

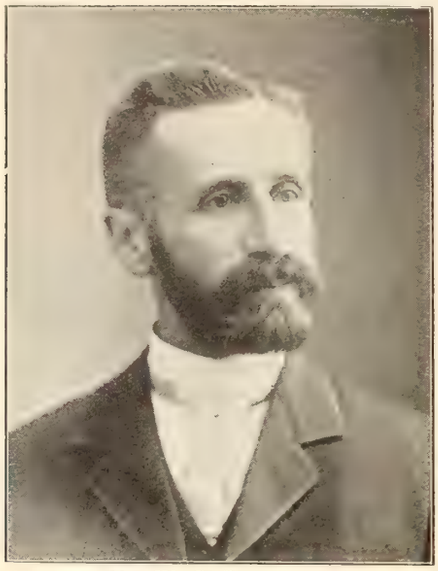
The car sheds and power house were built at De ch ne, where an excellent water power was available at low cost of production. The power house is built of w o 130 feet long and 40 feet wide. In it there are six 60-inch and two 52-inch American vertical turbines, capable of developing at the normal head of 10 feet, 1,300 h.p., the jack-shaft speed being 165 r. p. m.

The railway generators consist of two steel frame machines of the Canadian General Electric Company's standard type, having a capacity of 325 k.w. each. Power is also furnished from the jack-shaft to operate two 150 monocyclic alternators from which current is furnished for lighting purposes. In a second power house is situated one 250 k.w. monocyclic alternator. This is controllèd by a Woodward mechanical governor, which is giving good satisfaction. The first two mentioned are controlled by a Replogle governor. The current is transmitted over bare copper wire, at a voltage of 2,180 with no load, and 2,300 volts at full load. Current is used for the lighting system of the Hull Company in Hull, and the Deschene Electric Light Company in Ottawa. The use of water wheel governors alone not having been found sufficient to give a reasonably constant speed under the violent load fluctuations experienced when operating the electric locomotives and cars, this difficulty was overcome by a



Ottawa Power Company Interior of Power House.

simple and positive method. With the idea of keeping the load equal on the machines, despite the different variations on the road, an automatic load is thrown on at the power house. This is managed by means of an automatic electric switch. For example, when a car is going down grade or brought to a standstill, the outside load or pressure is thus removed from the machines. It is then that the local automatic action is applied.



MR. W. G. BRONSON,
Vice-President Ottawa Power Company.

Anchor ice has been a great source of trouble at power houses in the vicinity of Ottawa. This difficulty was overcome at the Hull Electric Company's plant, by the erection of a dam. The water moving at a reduced velocity, it is found, does not carry with it as much ice as it does at a higher speed. A wing dam 300 feet in length has been built, and the head of water thereby raised six inches. This company owns the water lots extending to the middle of the river, and it is estimated that between 3,000 and 4,000 additional h.p. can be developed. On the opposite shore, the Ontario side, are the extensive works of the Metropolitan Company, now under construction.

The Hull Company's power house narrowly escaped destruction by fire when the Conroy saw mills on the present site of the Capital Company's works, were burned two years ago. The premises are now fully protected. A rotary pump is installed with 400 revolutions and a capacity of 800 gallons a minute. The present electrical plant was installed at a cost of $35,000. It is modern and complete. Mr. James Robertson has been in charge since the plant was installed. He is an efficient electrician, wide awake, well read and in step in the matter of improvements.

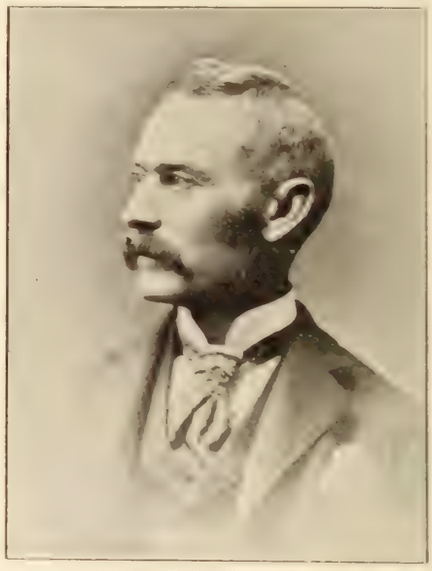


MR. LEVI CRANNELL,
Secretary-Treasurer Ottawa Power Company and Ottawa Carbide Company.

The car houses located next the main line at Deschenes are built of stone.

The rolling stock consists of 19 double truck motor cars, of which 13 are open and six closed. There are also two single truck 21 foot cars for use in Hull city, a spur line running for a distance of two miles along the Main street and northeast to Gilmour's mills. The equipment both for the open and closed cars consists of four G.E. 1,000 motors. The closed cars are geared to run at 35 miles an hour, and the open cars at 25 to 30 miles. The original equipment for the double truck cars was two 50 h.p. motors, but these were not equal to the occasion.

The Hull Electric Company also operates two electric locomotives, and a combination mail and baggage car. The latter is equipped with 2 G.E. 1,200 motors. The first locomotive purchased at the opening of the electric road, consists of a 22 foot 8-inch body mounted on heavy Blackwell trucks. It is equipped with four G.E. 1,200 motors, geared to run at 20 miles an hour. The second locomotive is a much more powerful machine. The body is 26 feet in length and the equipment consists of four G.E. 41 motors, capable of developing 80 h.p. each, mounted on McGuire "L" trucks with steel rimmed wheels. This locomotive is eqqipped with standard air brakes and operated by a motor driven compressor placed in the cab. As many as 33 freight cars have been handled, but the ordinary load is twelve loaded freight cars. For the smaller locomotive it is six loaded freight cars. The cost of repairs is low as compared with a steam locomotive. There is also a greatly reduced cost for cleaners and others.



MR. F. P. BRONSON,
Managing Director Ottawa Carbide Company.

The Hull Company has also a Ruggles rotary snow plow and a snow plow manufactured by the Canadian General Electric Company, known as the double nosed plow. By it the snow is taken from one side of the track, and lifted to the other, not divided in the centre as with the ordinary plow. The cars are also provided with attached plows. These have been operated with great success, as the road has been kept clear in storms that blocked the steam lines.

The officers of the Hull Electric Company are: Pres., W. P. Conroy; vice-pres., Alexander Fraser; sec.-treas., W. R. Taylor; trainmaster, A. E. Latimer. Mr. Taylor, who is an efficient, energetic official, popular with all patrons of the road, entered on his railraad career with the G.T.Ry. in accept a position with the Missouri Pacific. He remained with that company 10 years, and assumed his present position with the Hull Electric Company when the line was started. Mr. Albert E. Latimer, trainmaster, was formerly with the C. P. Ry before assuming his present position. All convention visitors should avail themselves of an opportunity to enjoy the run along the bank of the beautiful Ottawa on the Hull electric line.

OTTAWA CAR COMPANY.

A concern that has brought no small measure of fame and fortune to Ottawa and Ottawans is the Ottawa Car Company. Its extensive works are situated on Slater street, south of the Ottawa Electric Railway Company's car sheds on Albert street. The company build trolley cars, high grade waggons, carriages and other vehicles. Its army waggons won favorable comment during the South African war when they were used as transports by both Colonial troops and units from the British Isles. The concern was established in 1891, when it employed 30 hands. Now it employs over 100 men, and its cars cover the street railways of Canada from St. John's, N.B., to



MR. A. E. LATIMER,
Trainmaster, Hull Railway.

Vancouver, B.C. The weekly pay list is over $1,000, and 100 cars a year are turned out.

Electricity is used in the works as an auxiliary power to operate the heating and lighting systems after the steam plant is shut down for the day.

BELL TELEPHONE COMPANY.

In the last convention number of the Canadian Electrical News, this system was illustrated and described at considerable length. It was modern in every particular and its equipment is extensive and elaborate. The home of the company is on Queen street, near Elgin, in the business centre. The block is one of the most imposing in the Capital, being a three-storey solid brick, with sandstone trimmings. All lines entering the building come in in cables through the basement from the street underground system. These cables vary in size, from those containing 50 pairs of wires to larger ones of 200 capacity. At present there are about 3,000 miles of telephone wires underground in the city of Ottawa. The local manager is Mr. J. E. McPherson.

OTTAWA BRANCH G. N. W. TELEGRAPH COMPANY.

Away back in 1847, when dots and dashes played but little part in the business world, a class of young men



MR. W. R. TAYLOR,
Secretary Treasurer, Hull Electric Railway.

met in Montreal to study telegraphy. All but one of that class have left the telegraph key forever, the only survivor, Mr. N. W. Bethune, the superintendent of the Great North Western Telegraph Company, is still in the business. Every day he is at his office in the splendid building used by the G.N.W. Company as headquarters in Ottawa. Mr. Bethune is one of the oldest Canadian telegraphers. When he entered the class in 1847, it was to learn the dot and dash system so that he might be ready to take a position with the Montreal Telegraph Company, which was then building its lines. The class was under the tuition of Mr. O. S. Woods, the first superintendent of the Montreal Company, and who may be considered the father of the telegraph in Canada. Mr. Bethune has served in many offices in Canada. He spent some years of his early life in the United States, and in 1885 he returned to the service of the Montreal Telegraph Company as local manager of the Montreal office. He retained that position until 1893, when he was sent to Ottawa to prepare that office for the anticipated removal of the seat of government to Ottawa. He took an active share in the erection of lines throughout the Ottawa valley, and he has remained in charge of the district to the present day.

The Ottawa office of the G.N.W. Company is located in a fine three-storey structure of Nepean stone, faced with cut Ohio sandstone, at the northwest corner of Metcalfe and Sparks streets, in the best business section of the city.

The operating room, which is about fifty-three feet long, is situated on the third floor. It contains five quarter tables, each holding four sets of instruments, with one polar duplex and two setts of repeaters. There is also a range of side tables with glass partitions dividing the different setts of instruments, some of which are especially arranged for typewriters. A prominent feature of this room is the main switch-board capable of accommodating fifty lines and furnished with electric lamp detectors which give immediate warning of crossed or grounded lines, due to lighting or other causes. In rear of the switch-board is a small room containing the storage local batteries, with the dynamo for charging them and the necessary switches. Immediately above this room is the battery room containing the storage batteries for working all the lines running out of the office. Of these there are six



MR. N. W. BETHUNE,
Superintendent Ottawa Branch G. N. W. Telegraph Company.

to Montreal, six to Toronto, and also a dozen way lines running in different directions.

When Mr. Bethune came to Ottawa there were only sixty miles of telegraph wire leading from Ottawa. In 1901 there are nearly 3,000 miles of the G.N.W. wire alone. In 1893 there was only one sub office in the district, now there are 150. The staff in the Ottawa office numbers 50 made up of operators, clerks, messengers and linemen.

Mr. Bethune's district extends to the Island of Montreal on the east and to Kingston on the west, to Desert in the upper Gatineau and up the Ottawa river to Mattawa.

There are many "old telegraphers" in Ottawa, throughout Canada and the United States who have learned the business under Mr. Bethune, and they have none but the pleasantest recollections of the veteran chief. Time has dealt kindly with Mr. Bethune, and although he has reached a time in his life when most men retire from active business, he sticks to work and would pass easily for a man in the fifties. The photo of Mr. Bethune, which appears in this issue, although taken some years ago, represents the veteran as he is to-day—probably the oldest Canadian telegrapher in the business. Mr. Bethune was a superintendent when he was twenty-one years o

C. P. R. TELEGRAPH COMPANY.

Ottawa has the honor of being the first place in Canada where a storage battery has been installed for telegraph purposes. This plant was put in operation by the C.P.R. Telegraph Company, in 1896, and gave such general satisfaction that storage batteries have since been installed in St. John, N.B., Winnipeg, Vancouver, B.C., and elsewhere.

The line was opened for business in the fall of 1895, and the service has been so satisfactory to the general

public that the business has increased largely each ye making additional wires necessary. Many of these wires are worked duplex and quadruple. There are 28 wires radiating from Ottawa. Three of these are worked to Montreal and Toronto on the quad system, by which four operators can work on one wire simultaneously. There are branch offices in Ottawa at several points besides the main office on the corner of Elgin and Sparks streets.

THE EDDY ESTABLISHMENT.

Eddy's matches and woodenware have made Hull famous in thousands of households. The establishments are situated on the Quebec side of the Ottawa river, at the terminus of the Ottawa Electric Railway beyond the Chaudiere.

The electrical equipments of the Eddy establishment is board, supplied the Electrical Concstruction Company., of a unique and interesting one. Electrical energy is used for lighting, manufacturing and welding purposes, three distinct plants being in operation. Part of the fire-fighting apparatus is also operated by the same means.

The American generators, motors and other electrical machinery imported, were supplied and installed by Ahearn & Soper of Ottawa. A detailed description of the electrical equipment of this establishment was arranged for but lack of space prevents its publication.

J. R. BOOTH'S INDUSTRIES.

No visitor to the convention should miss a view of Mr. J. R. Booth's large lumber mill and extensive yards. The former and part of the latter are situated on Bridge street, at the Chaudiere. Electricity plays an important part in this industry. In the power house at the rear of the saw mill, are two 150 k.w. generators, 4,400 volts, utilized for the transmission of power to the Canada Atlantic Railway car chops four miles distant. This is known as the three-phase system. All the parts were installed by the Canadian General Electric Company, of



His Worship, Mayor Morris, of Ottawa.

Peterborough. Situated at these shops are three 100 k.w. synchronous motors, one at the car shops and two at the machine shops. By this system the lighting of the shops is also accomplished, there being installed 1,000 incandescent and several long burning arc lights.

The saw mill and adjacent buildings at the Chaudiere are lighted from five T. H. arc machines. There are 140 arc lamps and 600 incandescent lights. The work shop nearby is also run from a 25 h.p. motor, operated from the mill plant. In the power house are three kinds of wheels, the New American, Leffel and Sampson.

A factor in the Booth electrical system worthy of more than a passing note is one of the Thomson & Houston arc machines, which operates 35 lights. It was installed



Mr. G. F. Macdonald, City Electrician.

over 20 years ago by Mr. Fred Thomson, of Montreal, and is to-day doing effective and useful work.

FIRE PROTECTION EQUIPMENT.

Ottawa's electric fire alarm system is in charge of Mr George F. Macdonald, who has his office and work-shop in the city hall. The city is served by 100 boxes connected withthe central office and fire stations, by covered wire, of which there is 60 miles.

Superintendent MacDonald has kept step in the march of progress, and to-day, although the amount of outside wire has been increased 1,000 per cent., the system is operated with 75 per cent. less trouble than it was at the beginning.

Ottawa's fire department is the pride of the Capital. The head of the department is Chief Provost, a fire fighter of 18 years experience, who, previous to assuming control in Ottawa, was connected with the Montreal brigade. He has two deputy chiefs and 51 men. There are in the city nine well arranged attractive looking stations. The fire fighting appliances include a Lafranc steamer and a Waterous steamer recently purchased. There are also two aerial trucks, one in active service, besides nine hose waggons and two Seagrave hook and ladder trucks, the first adopted in Canada. Electricity plays an important part in the operations of the brigade.

NIGHT LAMPS.

For some time the Canadian General Electric Company have had on the market a night lamp which removes the objection to the incandescent lamp that it cannot be turned down or dimmed. By a simple movement of the milled screw, provided on this lamp, and shown in the accompanying illustration, the candle power is changed from 16 to 1. The device is economical as well as simple



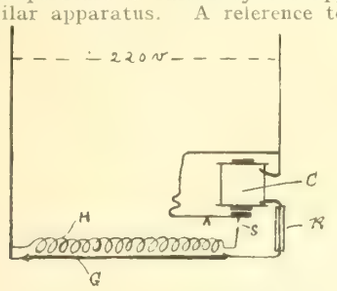
C. G. E. Night Lamp

since the current consumed is reduced with the candle power to a negligible amount. This feature will appeal ta consumers who find it necessary to keep lights burning all night. The Canadian General Electric Company advise us that the lamp has been found to be highly satisfactory. Other advantages claimed for it are that it fits any standard socket like an ordinary lamp, may be moved from one socket to another, and used with any kind of a shade or reflector and that no socket is available for giving lights of two different intensities

THE NERNST LAMP AT THE PAN-AMERICAN EXPOSITION.

(By a Correspondent.)

Probably the most interesting of the many features of the Pan-American Exposition on Dedication Day, Monday, May 20th, was the illumination of the central portion of the Electricity Building by means of Nernst lamps—the first public exhibition of Nernst lamps in America. When these lamps were turned on it was as if daylight were shining from the interior of the dome of the Electricity Building, and the arc lamps which up to this time appeared to light the building thoroughly were outshone completely by the brilliancy and numbers of the Nernst lamps. The Nernst lamp is famous for its efficiency, and those in charge of the display at Buffalo stated that the lamps they were exhibiting were rated at 1.5 watts per candle, or more than twice as efficient as the ordinary incandescent lamp. As is well known, the glower in the Nernst lamp is made of rare earths which are non-conductors until heated, and consequently the glower will not carry current until its temperature is raised by the application of a torch or similar apparatus. A reference to the diagram



will give an idea of how this arrangement is carried out at Buffalo, and it also shows a device for controlling the amount of current passing through the glower and the consequent brilliancy of the lamp.

G—glower which becomes a conductor when its temperature is raised sufficiently.

H—heater of German silver supported by an asbestos plaster case.

R—regulator made of iron wire enclosed in glass tube.

C—coil for operating a mature which controls switch in heater circuit.

S—switch.

The lamps are operated on a 220 volt circuit; when they are turned on current flows through the heater circuit and its switch, which is closed by gravity. As soon as the temperature of the glower begins to rise, its conductivity increases and current flows through it and its regulator R, as well as through the coil C, which latter is so arranged that when the current reaches a predetermined amount it lifts the armature which opens the switch S, thus cutting off the heater circuit and allowing the current to flow through the glower circuit only. The amount of current in the glower circuit remains constant under wide variations of pressure; the iron wire regulator's resistance increases so rapidly with an increase of current that it actually prevents the current from varying except within the narrowest margins.

The lamps are made in various sizes, those of high candle power being made up of a number of glowers in parallel, each glower being supplied with automatic heating and regulating devices. The glowers appeared to be about an inch and three-quarters long and one-eighth of an inch in diameter. The Westinghouse Company occupy the central portion of the Electricity Building, and they will use Nernst lamps exclusively during the Exposition, supplied with current from their own plant. On Dedication Day the Exposition authorities courteously supplied them with current, as their own apparatus was not ready. Mr. A. J. Wurtz, of Lightning Arrester fame, has developed the lamp described, and he has been assisted by Mr. Bert Fleming, formerly of Ottawa, who graciously described the workings of the lamp to a party of Canadians who visited the Exposition after the recent convention of the National Electric Light Association.

The La Patrie Publishing Company, Montreal, Que., have recently installed a 200 light dynamo, also switch board, supplied by the Electrical Construction Company of London, Limited. The La Patrie Company had shortly before this installed another dynamo, made by the same company.

The Electrical Construction Company of London, Limited, have recently completed the following contracts: Three dynamos for John Starr, Son & Co., Halifax, N. S.; five dynamos for Rennett & Wright, Toronto; three dynamos for Darling Bros., Montreal; 100 light dynamo for H. Shaw, St. Catharines; one 5 h.p. dynamo for Geo. A. McGowan, Kingston; one motor for the Thorold Pulp Company; two motors for L. Allcocks, Sault Ste Marie; three motors for Stuart, Arbuthnot Machinery Company, Winnipeg; two motors for the Electric Repair & Contracting Company, Montreal.

THE SAYER ELECTRIC COMPANY.

Prominent among electrical contractors and dealers in apparatus and supplies is the Sayer Electric Company, situated at 60 and 62 Victoria Square, Montreal, Que. This firm was established in 1896, E. W. Sayer being appointed manager. Mr. Sayer is a young man, 25 years of age, who has had a wide experience in electrical matters, having been associated for four years with T. W. Ness, and subsequently for two years with the Montreal



MR. E. W. SAYER,
Manager Sayer Electric Company.

Electric Company. The firm carries in stock all the most modern appliances known to the trade, and make a specialty of installing private power plants for arc and incandescent lighting, warehouse telephones, also doctor's and dentists' electrical specialties, which, wherever installed and used, have given satisfaction. The firm has recently installed plants in a large number of the prominent business establishments of Montreal, among them being Jas. Shearer Company, lumber merchants; Canadian Rubber Company, Canada Paint Company, Reinhardt & Company, brewers; and the Laing Manufacturing Company, St. Henri.

THOMAS A. FARRELL.

Prominent among the young and favorably known men in the electrical business is Mr. Thomas A. Farrell, who is located at 62 Victoria Square, Montreal. Mr. Farrell was associated with the well known firm of R. E. T. Pringle, where his genial personality and up-to-date business methods gained for him general esteem. Some time ago he decided to take up business on his own account, and the success which he has since met with has fully justified the wisdom of this step. In the short time he has been in business he has built up a large connection having filled orders from almost every part of the country. He has several agencies, the largest being the sole agency for the Electrical Construction Company, of London, Ont., with whom he is doing a large and increasing business, his territory embracing the Province of Quebec and Ontario, as far west as Kingston and north through the Ottawa valley. He is also the Canadian representative for the Warren Company, Chicago, U.S.

Mr. Thos. A. Farrell has recently installed a marble switch-board in John P. Black & Company's new plant, Montreal, Que.

As a result of the recent call for tenders for the new electric light plant for the town of Blenheim, Ont., the Electrical Construction Company, of London, Limited, have secured the complete contract for wiring, both street and house, supply of switch-board, transformers, and all other supplies needed.

Messrs. Babcock & Wilcox, Limited, whose advertisement appears in this number, will be pleased to send free to any of our subscribers a copy of their valuable treatise entitled "Steam." The company are prepared to give estimates for complete boiler house plants.

The Montmagny Light & Pulp Company., Montmagny, P.Q., who are now running their works by water power, are installing a steam plant for use during the dry summer seasons. It will consist of a 200 horse power Robb-Armstrong engine and two 100 horse power Mumford boilers, to be supplied by the Robb-Armstrong Engineering Company.

Mr. William S. Aldrich, who has been connected with the teaching staff of the Engineering Department of Illinois University, at Urbana, Ill., has decided to open an office in Toronto as consulting electrical engineer. Mr Aldrich has associated himself with Mr. Cecil B. Smith C.E., who has for several years been connected with the City Engineer's Department in Toronto, and who will make a specialty of municipal engineering work.

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The C. E. A.

In this number will be found the programme of the annual convention of the Association, which will open in Ottawa on the 19th inst. It will be seen that excellent provision has been made for the instruction and enjoyment of those who may participate. In the pages of this issue will also be found descriptions and numerous illustrations of the electrical and many other features of interest which the Capital has to offer for the pleasure and instruction of the stranger within her gates. The citizens of Ottawa are noted for their open-handed hospitality no less than for their business enterprise, and everybody who attends the coming convention will receive a cordial welcome. If the attendance should prove worthy of the occasion, as we earnestly hope it may, the meeting at Ottawa this year should be the most successful in the history of the Association.

The Nernst Lamp

We are indebted to a correspondent who recently visited Buffalo for the particulars and diagram printed in this number of the Nernst lamps that are being used to illuminate the Electric Tower at the Pan-American Exhibition. He speaks highly of the illuminating power of these lamps. Regarding their adaptability for commercial lighting, under ordinary conditions, our correspondent says: "There is undoubtedly a great future in store for the Nernst lamp, particularly as applied to the illumination of large interiors, such as departmental stores, public halls, etc. Its efficiency will make it a boon to both the central station and the consumer, and its beautiful color—nearly approaching daylight—places it in the foremost rank of illuminants. The question on every electric light man's lips at Buffalo was, 'When will you be in a position to supply us?'"

Meter Inspection

At the recent session of the Dominion Parliament, an amendment was made to the Electric Light Inspection Act. It provides that no meter, after it has been fixed for use, shall be verified or tested by any person excepting the Government inspector. In the event of an inspected meter being found on re-inspection to vary from the standard, the user is only to be entitled to the gain which has taken place during the three months immediately prior to such re-inspection. It also provides that no meter shall be stamped which is found by the inspector to register quantities varying from the legal standard unit of electricity more than three per cent. in favor of either the seller or consumer. If the meter is found correct, the fee, fifty cents, is to be paid by the consumer; if incorrect, by the electric light company. A clause of the amendment further provides that every person except the inspector who verifies or tests any meter after it has been fixed for use is rendered liable to a penalty of $25 for every meter verified or so tested. The Governor-General-in-Council is given power to establish regulations for the testing of electric light lamps, or to determine what style of meter shall be used to measure the quantity of electric energy supplied. The Gas Inspection Act was amended in like manner.

PERSONAL.

Mr. E. F. Valiquet of Marlbank, Ont., has recently been appointed eastern representative for the Dodge Manufacturing Company, Toronto, with headquarters in Montreal.

Mr. R. F. Morkill, formerly of Sherbrooke, has been appointed superintendent of the St. John's Street Railway System at St. John's, Newfoundland, which system is owned by Mr. R. G. Reid. Mr. Morkill has recently installed C. G. E. Series Alternating Enclosed Arc System 75 light special transformer, and is now engaged in changing the old ones.

Mr. W. Wallace, A.M.I.C.E., M.I.N.A., representing Messrs. John Brown & Co., Limited, Atlas Steel Works, Sheffield, is at present on a visit to the United States and Canada for the purpose of introducing in these markets certain lines of goods for which there is believed to be a demand. Mr. Wallace was formerly a resident of Hamilton, having been associated with late Mr. J. H. Lilley, and also with the development of the water works system of that city, and is consequently familiar with the conditions in this country.

Mr. J. G. Bain, traveller for the Atlantic Refining Company, Toronto, accompanied by Mrs. Bain, will sail from Montreal about the middle of June for the British Isles, where they will spend a couple of months. Mr. Bain's health has of late been somewhat impaired, hence his decision to take a well-earned vacation. Mrs. Bain is an accomplished vocalist and her Scotch songs will doubtless be appreciated in "The Land of the Heather." We wish them bon voyage.

NATIONAL ELECTRIC LIGHT ASSOCIATION.

About 350 persons were in attendance at the twenty-fourth convention of the National Electric Light Association, which opened in Niagara Falls, N.Y., on May 21st. The business proceedings were of an interesting character, but there were very few exhibits of electrical apparatus, due to the close proximity of the Pan-American Exposition.

Following the address of President Cahoon, a paper was read by C. W. Rice of New York, on "The Transmission of Current at High Potential in New York City," in the discussion of which a prominent part was taken by Frederic Nichols of Toronto. An interesting paper on "The Practical Side of the Incandescent Lamp" was read by Mr. F. W. Willcox, of the General Electric Company. It contained many suggestions of value to central station managers. A feature of the paper was that Mr. Willcox advocated free lamp renewals as the key to the incandescent-lighting system, and asserted that the lamps should be periodically replaced at regular intervals. L. R. Wallace, of Woburn, Mass., submitted a paper on "The Foresee System of Charging," the discussion on which was opened by Edward Slade of Quebec. A number of other valuable technical papers were presented and discussed.

In the absence of Dr. Louis Bell, James I. Ayer read the report of the committee on the standard candle power of incandescent lamps. It was stated that owing to changes in the shape of filaments, it was found advisable to take no further steps this year towards the standardization of lamps. The numerous changes were referred to in the report, which was referred to the executive committee, with power to act.

An interesting report was presented by the committee appointed to investigate the photometric value of arc lamps. The report stated what had been accomplished during the year, and dealt chiefly with the life and efficiency of commercial brands of enclosed arc lamps. Five well-known brands of carbons were tested, three of these being of American and two of European manufacture. It was shown that four of the five brands gave approximately the same luminous intensity after seventy-five hours' burning, and that nearly all the carbons showed a better performance after burning for several hours than at first.

The election of officers resulted in bringing distinction to a Canadian central station manager, Charles B. Hunt, of London, Ont., being chosen as second vice-president of the association. Honor was likewise done to another Canadian, in the preson of Frederic Nichols, vice-president and managing director of the Canadian General Electric Company, upon whom was conferred an honorary membership. Mr. Nichols is a past president of the association, and during his term of office gave the best of attention to the business of the association. It is understood that this is the second instance only in which an honorary membership has been given by the association, and it will doubtless be a source of congratulation that this distinction has fallen to Mr. Nichols, by whom it is well deserved.

The Canadians present at the convention included: Frederic Nichols, manager Canadian General Electric Company, Toronto; R. B. Hamilton and G. A. Powell, Packard Electric Company, St. Catharines; C. B. Hunt, London Electric Company; R. S. Kelsch, Lachine Rapids Hydraulic and Land Company, Montreal; Edward Slade, Jacques Cartier Water Power Company, Quebec; E. D. McCormick and H. G. Nichols, Canadian General Electric Company, Toronto; John Murphy, Ottawa Electric Company, Ottawa; George H. Olney, 2nd, Eugene F. Philips Electric Company, Montreal; E. F. Seixas, Niagara, St. Catharines and Toronto Railway Company.

ENGINEERING and MECHANICS

THE EXPANSION OF STEAM.*

One of the most interesting problems connected with the study of the steam engine is that of the laws governing the expansion of steam and their results as affecting the economy and efficiency of the modern steam engine.

Almost the first application of steam as a motive power was in the pumping of water from mines. The engines used for this purpose consisted of a vertical cylinder fitted with an air tight piston, and having its upper end open to the atmosphere. The piston was connected to one end of a walking beam, to the other end of which was attached the rods connecting it to the pump at the bottom of the mine, the weight of the plunger and connections being sufficient, when not in use, to draw the piston to the top of the cylinder. Steam was admitted below the piston at very little above atmospheric pressure, just sufficient to expel the air. When this was done and the cylinder filled with steam, the admission valve was closed and a jet of cold water was sprayed into the cylinder, condensing the steam and forming a vacuum below the piston, when the pressure of the atmosphere on the upper side of the piston forced it down, raising the other end of the beam, and the plunger of the pump with it, thus lifting the water. When the piston had descended as far as it would go, steam was again admitted to the cylinder, destroying the vacuum, when the weight of the plunger and connections raised the piston to the top of the cylinder again, ready to repeat the operation.

As you will see, the pressure of the steam played a very unimportant part in this engine, being only used to counteract the atmospheric pressure. It was found that the loss of time and heat required in the alternate heating and cooling of the cylinder walls made this a slow and expensive method, and this suggested the use of a separate vessel for condensing the steam, which was called a condenser. Gradually, too, the pressure of the steam was increased and taken advantage of to assist the atmospheric pressure; but for a long time the highest pressure used was about 6 or 7 pounds per square inch above the atmosphere.

As the phenomenon of heat and the laws governing the expansion of steam became better understood, the advantages of using still higher pressures and using the steam expansively became apparent, until to-day we have engines using steam of 300 pounds pressure, and expanding it to 15 or 20 times its original volume.

To illustrate the expansion power of steam I cannot do better than to quote from D. K. Clarke's excellent work on the steam engine.

"Let us assume a tall vertical cylinder, open at the upper end into which a piston is inserted with a quantity of water at the bottom and a fire applied below to convert the water into steam. In this case, the boiler and engine are represented by one vessel in which the piston and the water are brought into direct contact, and intervening pipes and passages for the steam are dispensed with. Let the cylinder have a diameter of about 13 1-2 inches, making one square foot of sectional area. In the bottom of this cylinder we will put one pound of water, equal to a little less than one-fifth of an inch in depth, on which the piston rests. Let a fire be lit underneath the cylinder to heat the water and convert it into steam. Since the upper end of the cylinder is open to the atmosphere, atmospheric pressure, equal to 14.7 lbs. per square inch, acts upon the piston, amounting to 2,116.4 pounds on the square foot of surface of the piston. The temperature of the water under atmospheric pressure will be raised to 212 degrees Fah. before any steam is generated, and if the heat of the fire be continued the temperature will remain stationary at 212 degrees, but steam will be formed and disengaged under the piston. To simplify our illustration, we will assume that the piston is without weight and frictionless. As steam is formed, the piston will be raised with its atmospheric load of 2,116.4 pounds through consecutive stages until it reaches an elevation of 26.36 feet from the bottom of the cylinder, when the whole of the pound of water will have been evaporated, having had a constant elasticity of 14.7 pounds per square inch and a temperature of 212 degrees Fah.; that is to say, the pound of water is evaporated into saturated steam of atmospheric pressure and occupies a volume of 26.36 cubic feet for the sectional area of the piston, being one square foot, and the height to which it is raised being 26.36 feet, the capacity or volume of the steam equals 1x26.36 equals 26.36 cubic feet. The work done by the steam on the piston consists in having lifted a weight of 2116.4 pounds through a height of 26.36, which expressed in foot pounds is 2116.4x26.36 equal 55.788 foot pounds."

Such an experiment as the one described affords a vivid conception of the expansiveness and force of water when converted into steam. A stratum of water scarcely one-fifth of an inch in thickness lies at the bottom of a cylinder 13 1-2 inches in diameter. This thin disc of water is converted by the application of heat into a column of atmospheric steam of 1,642 times its volume, and the work that has been done in converting the water into steam is equal to the lifting of 27 tons (2000 pounds each) and 1788 one foot high. As the heat unit is equivalent to 772 foot pounds, the value of this performance expressed in heat units converted into work is:—

$$\frac{55.788}{772} = 72.3 \text{ units of heat.}$$

In the foregoing illustration we have assumed that the piston was without weight and frictionless. Let us now assume that it (the piston) has a weight equal to 15 pounds per square inch, or 2,160 pounds. This added to the atmospheric pressure would bring the total load on the piston to 30 pounds per square inch, or two atmospheres, equal to 4,320 pounds. We will again place one pound of water in the bottom of the cylinder on which the piston rests, and lighting a fire under it we will find that the temperature of the water will rise to 250.4 degrees Fah. before any steam is generated. If the heat of the fire be continued, the temperature will remain stationary at that point, but steam will be formed and disengaged under the piston as before. The piston, with its total load of 4,320 pounds, will be raised through successive stages until it reaches an elevation of 13.46 feet above the bottom of the cylinder, when the whole of the pound of water will have been evaporated into steam having a constant elasticity of 30 pounds (gross) per square inch.

The external work done will in this case have been 4,320 pounds raised to a height of 13.46 feet, or 58.147 foot pounds, as against 55.788 foot pounds in the first example. Dividing 58.147 foot pounds by 772, the mechanical equivalent of one heat unit, we have 75.3 heat units converted into work as against 72.3 H.U. in the first illustration. The water will have expanded into 849 times its original volume against 1,642 times under one atmosphere of pressure. To make this more clear I will put it in the form of a table:—

Experiment	Gross Press. lbs. per sq. in.	Volume.	Relative Volume of Steam.	Gross Work.	H. U. Equivalent.
1	14.7	26.36	1642	55.788	72.3
2	30	13.46	849	58.147	75.3

From this statement it will be seen that the volumes occupied by the steam generated under increasing pressures are reduced nearly in the inverse ratio of the pressures, but not quite so fast, so that as a result the products of the pressures by the volumes, or the gross work done by the steam, is slightly increased with the increase of pressure, and of course the quantity of heat converted into work, the gross work done against two atmospheres being 4 per cent. more than that against one. The total heat expended in generating one pound of steam is also increased with the pressure, the heat units required (assuming the water to be supplied at 212 degrees Fah.) to convert one pound of water into steam at atmospheric pressure being 965.2, and at two atmospheres (30 pounds equals 976.9.

Having thus illustrated the expansion force of water when converted into steam, let us briefly consider how it affects the efficiency of the steam engine. For this purpose we will assume a steam cylinder 13 1-2 inches diameter and having a stroke of 4 feet; a 13 1-2 cylinder would have an area of (approximately) 1 square foot, and the cylinder would have a volume of 4 cubic feet.

For the sake of simplifying our illustration, we will neglect clearance, cylinder condensation, etc. We will assume that steam is admitted to this cylinder at a pressure of 100 pounds. The pressure on the piston would then be 144x100 equals 14,400 pounds. Let the steam be admitted for the full length of the stroke, we would have 14,400 pounds moved a distance of 4 feet, or 57,600 foot pounds on an expenditure of 4 cubic feet of steam.

Let us next take a cylinder of 27 inches diameter, or 4 square feet area of piston. This cylinder would also have a stroke of 4 feet, or a cubic capacity of 16 cubic feet. Let steam be admitted to this cylinder also at 100 pounds pressure per square inch. But when the piston has moved a distance of 1 foot from the beginning of its stroke we will close the admission valve, thus preventing any more steam from entering the cylinder. We have now admitted 4 cubic feet of steam, the same as in the first example; and the pressure on the piston being 576 inches x100 or 57,600 pounds, and the piston having moved a distance of 1 foot, the work done is 57,600 foot pounds, or exactly the same as in the smaller cylinder. But we still have 4 cubic feet of steam at its original pressure of 100 pounds per square inch imprisoned behind the piston,

*Paper by Mr. O. P. St. John, read before Toronto No. 1, Canadian Association Stationary Engineers

and as the piston still has three feet of its stroke to complete, it will, if the resistance be not too great, continue to move, impelled by the pressure of the steam behind it. When it has moved another foot, or two feet in all, the volume of steam will have increased to 8 cubic feet; but as the admission valve was closed at the end of the first foot of its stroke, and no more steam has entered the cylinder after that, the pressure will be reduced.

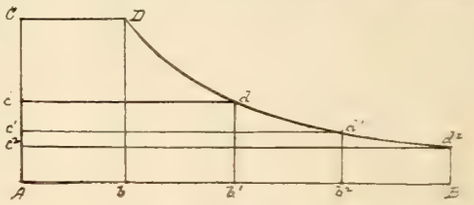
The investigations of Boyle & Marriotte into the laws governing the expansion of the gases show that, practically speaking, the pressure decreases in an inverse ratio as the volume increases; so that while we have twice the volume in this case, we would have at the end of the second foot just one-half the pressure, or 50 pounds per square inch impelling the piston forward. At the end of the third foot of its stroke, the volume would have increased three times, or to 12 cubic feet, while the pressure would have decreased to one-third the original pressure, or 33 1-3 pounds; and at the end of the 4th or last foot of its stroke the volume of steam would be four times its original volume, or 16 cubic feet while the pressure would have fallen to 25 pounds per square inch, or 1-4 the initial pressure, when the exhaust valve would open and the steam be allowed to escape. If we calculate the average pressure on the piston during its whole stroke, we will find that it amounts to 59.6 pounds per square inch. This is called the Mean Effective Pressure. Multiplying the area of the piston, 576 square inches, by this pressure, we find that it amounts to 34,329.6 pounds moved a distance of 4 feet, or 137318.4 foot pounds. Thus the work done by 4 cubic feet of steam in the first cylinder without expansion was 57,600 foot pounds; while the work done by the same quantity of steam in the second cylinder, with expansions (or cutting off at 1-4 stroke, as it is called) amounted to 137318.4 foot pounds.

I have already shown you that the work done by the steam in the second or larger cylinder up to the point of cut off was exactly the same as that done in the smaller cylinder carrying the steam the full length of its stroke, viz., 57,600 foot pounds. If we subtract this from the total work done in the larger cylinder, we will find that the work done by expansion equals 137318.4 − 57600 = 70718.4 foot pounds, or a little more than 138 per cent. of the work done previous to expansion; or for every 100 pounds of work done previous to expansion 138 pounds of useful work is done after steam is cut off when cutting off at one-quarter stroke. If we divide the work done after cut off, or by expansion, by the work done previous to expansion, we have 79718.4 ÷ 57600 = 1.3863, and this will be found to be the hyperbolic log of 4, which was the number of expansions. As this ratio is the same with all other pressures as well as with 100 pounds, it is only necessary, when wishing to find the Mean Effective Pressure, to divide the initial pressure by the number of expansions and multiply the quotient thus found by the hyperbolic log, increased by 1. Let me try to explain this more clearly. In the example just given we found that the work done previous to expansion being taken as 1, the work done after expansion (with four expansions) was 1.3863, which, as I stated, is the hyperbolic log. of 4. Adding the work done before cut off to the work done by expansion, we have 1 + 1.3863 = 2.3863. Dividing 100 pounds, the initial pressure, by the number of expansions 4, we have $\frac{100}{4} = 25$ pounds, and this multiplied by 2.3863 gives us 59.6, which is the M. E. P. of 100 pounds cut off at one-quarter stroke.

Another example: What would be the mean effective pressure in a cylinder the initial pressure being 75 pounds and the steam being cut off at one-quarter stroke. $\frac{75}{4} \times (1 + 1.3863 = 44.74 + = \text{M. E. P.}$ This is the easiest and most accurate method of finding the M. E. P., the only drawback being that one cannot always have a table of hyperbolic log. handy.

In the illustration which I have given we found that using an initial pressure of 100 pounds per square inch, and cutting off the steam at one-quarter stroke, we had a terminal pressure of 25 pounds. The question naturally suggests itself, is not this 25 pounds per square inch still capable of doing useful work, and if so, why not cut the steam off at a still earlier period and thus utilize the remaining pressure at the termination of the stroke? It is quite true that the terminal pressure of 25 pounds is capable of still doing more work, and the steam could be cut off at one-fifth stroke and have a terminal pressure of 20 pounds (100 ÷ 5 = 20), or at one-sixth stroke and have a terminal pressure of 16⅔ pounds., or at ⅛ stroke, and have a terminal pressure of 12½ pounds. But here the question of cylinder condensation comes in. The difference of temperature between the steam entering and leaving the cylinder, where a great number of expansions are made, is so great that the loss of heat in reheating the cylinder walls more than counterbalances the benefit obtained. It has been found in practice that there is no benefit obtained by expanding the steam more than 6 times in a single cylinder. Where a high pressure and a greater number of expansions are desired, the use for a second, a third, and a fourth cylinder is the only economical way of accomplishing this end, as in the case of the compound triple expansion and quadruple expansion engines; the steam leaving the first or high pressure cylinder at a high terminal pressure, and being expanded in the succeeding cylinders down to the desired point, in which case the variation in temperature between the initial and terminal pressures is distributed between the 2, 3, or 4 cylinders used, and consequently is not so great in any one.

I have already shown you that the work done by expansion, as compared with the work done previous to expansion, is represented by the hyperbolic logarithm of the number of expansions. I will endeavor to explain as simply as possible the meaning of the term "hyperbolic log" and how it may be used in calculating the Mean Effective Pressure on the piston. This can best be done by a card (fig. 1), in which the line A B represents the atmospheric line and also the stroke of the piston, and the vertical lines AC, b D, b^1 d, b^2 d^1 and B d^2 the pressure on the piston, steam being admitted to the cylinder. The line CD represents the admission line at D, the admission valve is closed, and as the piston advances the volume of steam in the cylinder increases and the pressure decreases until when b is reached the volume is increased to twice its original size and the pressure has decreased to one-half, represented by the vertical line b^1 d. If we now draw the line c d parallel to A b^1 we will find that the area of the figure contained within the lines A b^1 d and c is the same as the area of the figure contained between the lines A b D C representing the volume of steam before cut off. When the piston has advanced to three-quarters of its stroke b^2, the volume will have increased to three times and the pressure will have fallen to one-third the initial pressure, and will be represented by the vertical line b^2 d^1. Again, we find that the area contained by the



lines A b^2 d^1 c^1 is the same as the area of the figure A b D C, representing the work done before cut off. When the piston has reached the end of the stroke the volume of steam will have increased 4 times and the pressure will have fallen to one-fourth the original pressure, represented by B d^2. Connecting b^2 c^2 by a horizontal line parallel to A B, we find the area of the parallelogram A B d^2 c^2 still equal to the area occupied by the steam previous to cut-off. The pressure at any intermediate point between the point of cut-off and end of stroke can be determined in the same manner.

If we now join the points D d d^1 and d^2 by a curved line cutting all these points, we have what is usually called the expansion line or curve. The figure contained between this curved line and the lines B d D is called a Hyperbola. If we carefully measure the area of this hyperbola, we will find that it is 1.3863 times the area of the parallellogram A b D C, and consequently the work done by expansion is 1.3863 times the work done previous to cut-off. As this proportion is the same in all cases when steam is cut off at one-quarter stroke, no matter what the initial pressure may be, we can use it in all cases. And this proportion is called the Hyperbolic Log. of the number of expansions. The hyperbolic logarithms of numbers are computed by multiplying the common logarithm by the constant multiplier 2.302585. In the same manner as I have described it will be found that cutting off at one-fifth stroke, or with five expansions, the hyperbolic log is 1.6094 equal the hyperbolic log. of 5, etc.

It must be remembered that in the illustration which I have given the expansion curve is the theoretical curve. In actual practice it is almost impossible to obtain such a curve owing to the variation in temperature at the different points of the stroke, cylinder condensation and other causes.

The use of hyperbolic logs. affords one of the simplest and easiest methods of determining the Mean Effective Pressure on the piston of an engine. In using this method it is necessary to first find the number of expansions; this is done by dividing the length of the stroke by the distance travelled by the piston before cut-off. Dividing the initial pressure by number of expansions will give the terminal pressure, and this multiplied by the hyperbolic log. increased by 1 will give M. E. P.

Example: What would be the Mean Effective Pressure on the piston of an engine, initial pressure being 80 pounds gauge, pressure cut off at one-quarter stroke? Cutting off at one-quarter stroke would give four expansions, and 80 pounds (initial pressure) divided by 4 equal 20 pounds as the terminal pressure. The hyperbolic log. of 4 equals 1.3863 which represents the work done by expansion, and this increased by 1 (the work done previous to cut-off) equals 2.3863; multiplying the terminal pressure, 20 pounds, by 2.3863 equals 47.726, which would be the Mean Effective Pressure required.

In calculating the M. E. P. of a compound or triple expansion engine it is only necessary to reduce the H. P. and intermediate cylinder to terms of the L. P. cylinder and proceed as if the total expansion took place in one cylinder.

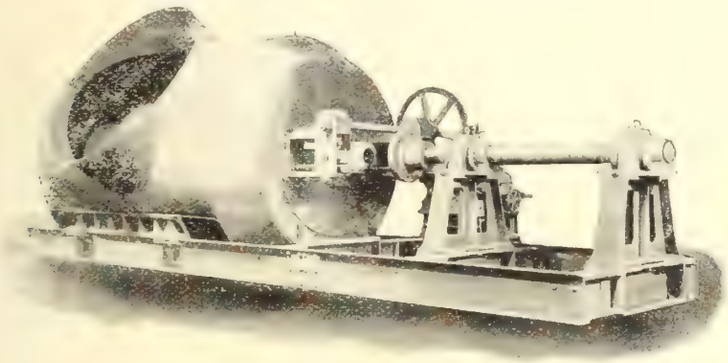
ONTARIO ASSOCIATION STATIONARY ENGINEERS

The yearly meeting of the Ontario Association of Stationary Engineers was held in Berlin on May 7th, opening at 11.30 a.m. A letter of regret was read from the president, O. P. St. John. Reading of minutes, reports of officers and last year's committees and appointment of committees was accomplished before lunch. The report of the registrar, J. G. Bain, showed over 1,000 names on the books. Upon re-opening at 2 p.m., the report of the Committee on the Good of the Order was received and fully discussed and finally passed. Their recommendations were principally along the lines of strengthening the means to secure prompt renewals of certificates each year. The Legislation Committee reported in full the work done for license law during the last session of the Ontario Legislature, stating to the members that an amendment to the Factories' Act had been passed making it compulsory that all boilers coming under the Act be inspected at least once a year, and recommending the appointment of a committee for the purpose of waiting upon the Government concerning the kind of inspection to be made, and to assist in any legitimate way in carrying out the law.

The election of the four members on the Board resulted in the re-election of Thomas Elliott of Hamilton, and A. Ames of Brantford. The new members were Charles Moseley of Toronto, and George Fowler of Toronto. The election of officers resulted as follows: President, Thomas Elliott, Hamilton; vice-president, F. W. Donaldson, Toronto; registrar, J. G. Bain, 113 Yorkville avenue, Toronto; treasurer, A. M. Wickens, Toronto.

INSTALLATION OF VICTOR TURBINES.

The McCloud River Electrical Company, of San Francisco, Cal., are now installing four units of Victor turbines, with cylinder gate, mounted on horizontal shafts; each unit to develop 790 h.p. under 36 feet working head of water, and running at 270 revolutions per minute. Each unit consists of two 30 inch Victor turbines mounted in a steel flume and discharging into one central draft-tube. The flumes are 15 ft. 9 inches long, 9 ft. 6 inches diameter, constructed of heavy steel plate, with cast iron heads and covers.



"Victor" Turbines in McCloud River Electrical Company's Plant.

The gate work is the patented draw-rod type, which places all gears on the outside of the flume where they can have attention and where they can work in oil, doing away with the old style of gate work where the gears run in water and where they are continually causing trouble. The patents on this style of gate work are, we understand, completely controlled by the builders of the turbines, the Still-Bierce & Smith-Vaile Co., Dayton, Ohio.

The plant is being installed in the northern part of California. The wheels are set on top of concrete arches, the draft-tubes reaching through to the tail water below. Each unit is equipped with a large rope pulley, and the dynamos are driven by means of rope drive, being located at a higher elevation than the water wheels. The feeder pipes come through the foundations upon which the generators set, and the whole is a very substantial and complete plant.



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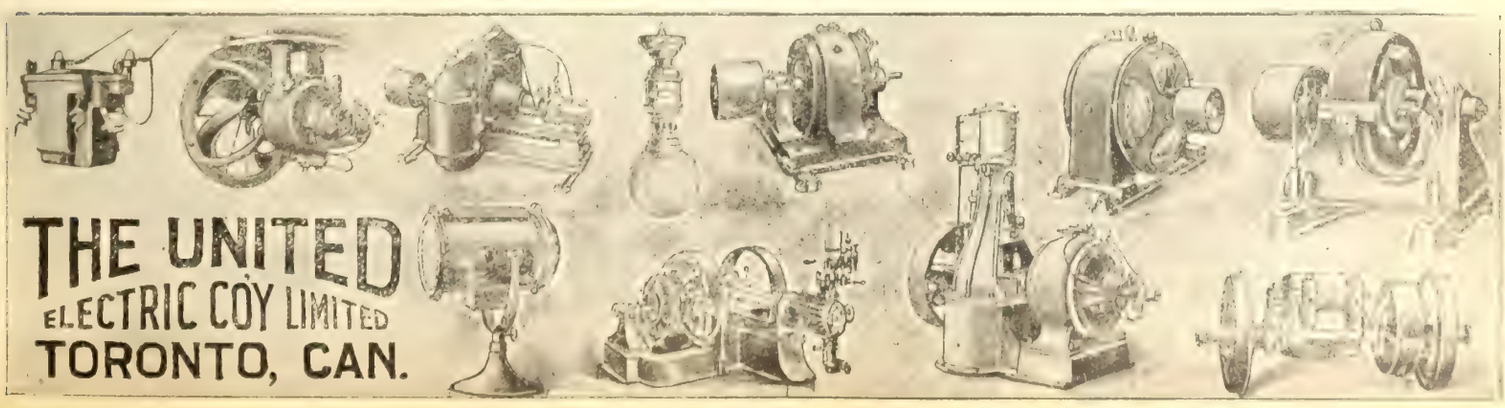
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PATENT OFFICE HISTORY AND PROCEDURE IN CANADA.

Observation proves the truth of the proverb "Be satisfied and you will be happy;" who then can say that the inventor is not the happiest of men? (at least until he tries to find a purchaser for his invention—but his condition at that stage does not concern this article.) When you meet him, at least one big pocket bulging with his "papers," a word with him—if he is so modest as to limit his conversation; and even with such modest ones, deep down in their hearts it is the same story—will convince you that he is thoroughly satisfied, he is positive that his invention is the simplest, the best idea that ever human brain produced for the benefit and welfare of mankind, and "there are millions in it!" Before there was such a thing as a Patent Office, there were comparatively few inventors, and, as a class, they were generally frowned down, but at the dawn of this day of progress and enlightenment. Canada, always to the fore in encouraging the happiness of her people, looked to the establishment of a Canadian Patent Office.

Although the Canadian Patent Office was not constituted until the passage of the first Canadian Patent Act (32, 33 Vic. c. 11.), which was assented to on June 22nd, 1869, the history of legislation relating to patents of invention dates back in Lower Canada to a statute of 1823 (4 Geo. IV., c. 25), and in Upper Canada to one of 1826 (7 Geo. IV., c. 5). On the passage of the Act of 1852 (16 Vic. c. 11), the jurisdiction was transferred from the Provincial Secretary to the Minister of Agriculture. By the Patent Act of 1872 (35 Vic. c. 26) foreigners were enabled to obtain patents on the same terms as Canadians, the restrictions as to residence in Canada for one year as contained in the sixth section of the Act of 1869 being withdrawn.

The patents granted from 1823 to the passage of the Act of 1869 were numbered from 1 to 3,325, and after that the enumeration began again at 1. In bound volumes I and II may be seen the specifications and in some cases the drawings of patents issued up to August, 1854, but there is an unaccountable gap between that date and 1869. Beginning with patent No. 1 of the later issue, copies of the specifications and drawings are kept on file in the Patent Office and may be seen on application.

The examination of applications for patents was until the year 1873 in charge of one person. Further appointments were made in 1884 and in 1887, but the staff remained three in number until late in 1897, when the attention of the present Minister, Hon. Sydney Fisher, was called to the alarming rate at which the work of the office was unavoidably going behind; he immediately took steps to increase the number of examiners with a view of putting the office on a satisfactory basis. There is now a staff of eight examiners, and although the output of patents has not shown a proportionate increase, still when the actions are understood to include grants and reports, not only, as expected, will a greater volume of work be found to have been done, but it will be noticed that, as more time is now given to each case, a correspondingly better action is taken. Favorable progress is being made, and it is expected that in the near future each examiner will not be more than three months behind in his work.

The Canadian Patent Office is under the jurisdiction of the Minister of Agriculture, who is ex officio Commissioner of Patents. The Deputy Minister is the Deputy Commissioner of Patents. All communications must be addressed "The Commissioner of Patents, Ottawa, Canada."

A patent in Canada is granted for eighteen years. It is made optional with the patentee to pay the full fee of $60 for the eighteen years, or by installments of $20 for each term of six years, but the fee for a further term of six years must be paid before the expiration of the term previously paid for. Consequently the smallest fee accepted at the filing of the application papers is $20, of which $10 is refunded if the petition is refused or the case withdrawn.

Section 14 of the Act of 1872 (35 V. c. 26), requiring the inventor to furnish a model with his application, was repealed by the Act of 1892 (55-56 V. c. 24), which, however, allows the examiner to call for a model if he finds it necessary to aid him in making out the alleged invention.

A person who has obtained a patent in a foreign country must apply for his Canadian patent within one year after the date of issue of such foreign patent. If within three months after the granting of such foreign patent he notifies the office of his intention to apply for a patent for the same invention, no other person who commences to manufacture such device in Canada during a period of one year after the issue of such foreign patent shall be entitled to continue to manufacture the same, after the inventor has obtained a patent therefor in Canada, without the consent of the inventor. Conflicting applications are referred to three arbitrators, two of whom are chosen by the applicants, one by each, and the third by the Commissioner. The arbitrators may summon witnesses before them and their decision or award, submitted in writing to the Commissioner, is final as far as concerns the grant of the patent. The fee of the arbitrators is a matter of agreement between them and the applicants, each arbitrator being paid by the applicant by whom he is named, the arbitrator named by the Commissioner being paid by the applicants jointly. Patents for invention may be assigned in whole or in part, but if such assignment is not registered in the Patent Office it will not remain in force against a subsequent assignment that has been registered.

Section 37 of the Patent Act provides that a patent becomes forfeited

(1) at the end of two years after the grant of such patent unless the patentee, his representative or assignee commences and carries on the manufacture of his invention in order that others who desire may obtain it at a reasonable price;

(2) if after twelve months from the granting of the patent the patentee, his representative or assignee imports the invention into Canada; but applications for extensions for further terms of one year are favorably considered when the Commissioner is satisfied that the inventor could not, for reasons beyond his control, comply with the law in this respect. Such applications may be made in writing direct to the Commissioner; no fee is exacted by the office.

An intending inventor, native or foreign, who has not perfected his invention and is in fear of being despoiled of his idea, may file a description of the same in the Patent Office. The fee for the lodgement of such a document, called a caveat, is $5. The caveat is preserved in secrecy and if, during the term of one year from the filing of such caveat, application is made by another inventor for a patent for an invention with which such caveat may in any way interfere, the Commissioner is obliged to give the caveator notice of such an application in order that the latter, if he wishes, may file, within the three months allowed him by law, his petition and application with the statutory fee. If the applications are found to conflict the usual proceedings with regard to conflicting applications are taken.

Although copies of the rules and forms are obtainable on application to the Patent Office, and an inventor with some knowledge of drawing may be able to prepare his own case, still it is generally advisable for him to employ a skilled attorney for the purpose. The latter will usually prepare a more full and complete description of the invention, and from his knowledge of the rules of practice will be able to argue and to make the amendments required to meet and overcome the objections raised by the examiner, resulting in an earlier issue than if the applicant had prosecuted his own case.

The applicant has a right to amend his case before and after the first rejection, but must not submit new matter involving a departure from the original invention. On receiving an official report he should not reject the examiner's action as some inventors have done—but study his case; he should bear in mind that he is better acquainted with his own invention than the examiner, no matter how fully it has been described and shown. The applicant should look thoroughly into the references cited, and in reply to the examiner's report he should distinguish

the new from the old and point out the novelty presented in view of the state of the art as disclosed by the references cited. With each such reply the applicant should send a letter setting forth precisely what amendments he has made.

Many inventors persist in claiming as new some old or slight modification of an old apparatus, and in due course an adverse report is received from the office. A rejection is not well received by the applicant in his blindness, and it is pleaded that, in view of the fact that the references cited do not show the identical construction of the applicant's device, he should be given the benefit of the doubt. The difference between invention and mechanical skill not being clearly defined, the examiner as a rule gives way to the weight of testimony submitted and, in the majority of cases, an allowance follows ; the result is usually a worse than useless patent, as a forced resource to the law courts proves. In some such manner too an inventor will sometimes obtain a patent for an apparently inoperative device and the technical journals immediately censure the sleepy-eye examiner, although, as a rule, the criticism should be directed towards the obstinate inventor.

Inventors are requested by the examiners not to file applications for perpetual motions—at least not until they have given their inventions a fair trial.

In the electrical, as in other departments, the Canadian Patent Office will be found to have steadily progressed. The first patents of an electrical nature were the following, granted under the earliest Acts, above mentioned, to Gilbert McMicken : —

No. 114 (Lower Canada), for an "Improvement in the Method of Constructing an Electromagnetic Telegraph, Montreal, dated 29th June, 1847 ; and No. 231 (Upper Canada), for "Certain Improvements in the Application of the Principle of the Electromagnetic Telegraph, designated the Notifier and Connector or Transfer Magnet," Montreal, dated 8th June, 1847.

Since March, 1873, there have been issued 3,560 patents for invention relating to electrical subjects. The following table gives the number granted to Canadians, citizens of the United States and other foreigners :

Year	Can.	U.S.	Foreign.	Year.	Can.	U.S.	Foreign.
1873	1	1	7	1887	16	13	115
1874	2	0	11	1888	11	17	67
1875	5	3	9	1889	11	22	136
1876	3	1	14	1890	22	11	108
1877	4	2	5	1891	18	11	92
1878	7	2	8	1892	23	35	206
1879	5	3	29	1893	29	36	234
1880	5	3	34	1894	29	29	125
1881	12	13	87	1895	17	30	181
1882	9	23	82	1896	19	49	157
1883	11	40	82	1897	12	37	106
1884	13	13	107	1898	11	36	171
1885	9	7	70	1899	16	32	132
1886	14	13	72	1900	27	57	213
			622				2042

Total for the 28 years, 2665

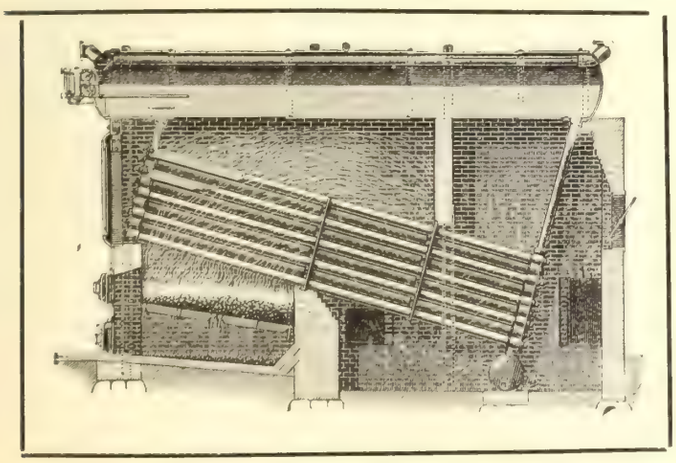
PUBLICATIONS.

Messrs. Spon & Chamberlain, of 12 Cortlandt street, New York, have issued the second edition of their book "Induction Coils." It has been thoroughly revised and brought up to the latest American practice, and should be very useful as showing how to make, use, and repair induction coils. Bound in cloth ; price $1.00.

"Central Station Experiences" is the title of a book just issued by the Power Publishing Company, of New York. It contains a series of narratives on the trials and tribulations of a steam engineer while learning to run an electric station. The price of the book in stiff board binding is 75 cents ; bound in cloth, $1.00.

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DAVID SLEETH

Sole Agent for Canada

13 St. John Street, - MONTREAL



SPARKS.

James A. Bell, city engineer, of St. Thomas, Ont., has reported that it would cost $3,000 to install an electric plant to light the municipal and public buildings of the city. The council will probably submit a by-law to the ratepayers to raise the necessary funds.

A special committee of the town council of Collingwood, Ont., have recommended that a by-law be again submitted to the ratepayers to raise $12,000 for extending improving the electric light and waterworks systems. A proposition has been made by Messrs. Dancy & Toner to purchase the electric light plant and install a gas plant in connection therewith.

At a recent meeting of the Montreal city council, a letter was read from the Shawinigan Water & Power Company, of Shawinigan Falls, Que., stating that the company was ready to expend large sums of money in the development of electric power, and that a transmission line was shortly to be constructed from Shawinigan Falls to Montreal. The company requested permission to enter the city.

The following appears in an exchange, and refers to the lighting plant recently established by the town of Barrie, Ont. : "The council of the county town have discovered that the municipal lighting plant is not a money saver, but the opposite. During the past three years it has been continually going behind, with the result that there is an over-draft in the bank on this account of $3,080. To meet this state of affairs the council have decided to advance the late rates 10 to 20 per cent., and thus secure an ditional revenue of nearly $1,000."

A conductor of the Toronto Surburban Street Railway Company was holding the trolley rope tightly in his hands, when, owing to a defect in the joint in the wire above, his thumb was pulled off. He sued in the Assize Court, Toronto, for damages, and the jury gave a verdict in his favor for $400, on the ground that the company was responsible for accidents caused by defects in its appliances

New York capitalists are putting forward a scheme to supply power and water in Montreal by means of a compressed air plant. A representative of the company states that the water power of the Lachine Rapids between the Lachine Rapids Hydraulic & Land Company's plant and the Isle Heron has been secured, and arrangements made with the Taylor Hydraulic Air Compressing Company to use their system. The estimated power to be develo is given as 50,000 horse power. It is further stated that work will be begun within the next three months

ELECTRICAL REPAIRS

In the large and well equipped factories where the manufacture of electrical apparatus is carried out under the piece work system, they find that repair work or apparatus sent in to be repaired or rewound interferes with this system, and in many cases they would prefer not to do this kind of work, as it is almost impossible to do it with dispatch and at a reasonable price. Knowing the above to be a fact,

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Western Office : 419 Hastings Street, VANCOUVER, B. C.

SPARKS.

Extensions are being made to the street railway system of Yarmouth, N.S.

The St. Thomas Street Railway Company are considering the extension of their road to Port Stanley.

Tenders will likely be let this week for the erection of a power house for the corporation of Bracebridge, Ont.

The Victoria & Esquimalt Telephone Company are extending their system to the northern end of the Saanich peninsula.

The Canadian General Electric Company have secured the contract for installing an electric light plant for the corporation of Thessalon, Ont.

The Hamilton Street Railway Company have been granted right of way through Barton township for an extension of the railway line to Bartonville.

The town council of Sandwich, Ont., have granted a franchise to John A. Auld, M.P.P., representing the South Essex Electric Company, to build an electric road from Windsor to Amherstburg, Ont. The road must be completed within two years.

A motion to submit a by-law to raise $50,000 to purchase the electric light and telephone plants of Rat Portage, Ont., was recently introduced in council.

At a recent meeting of the Mining Association a paper on "Electric Transmission and Electric Drills" was presented by F. Hille, M.E., of Port Arthur, Ont.

Voting on a by-law to raise funds to extend the electric light plant of St. Mary's, Ont., will take place on 2nd. The proposed improvements include a new dynamo, engine and boiler.

Mr. Littlehales, of Syracuse, formerly of Hamilton, Ont. has been appointed the city's expert in the valuation of the gas plant in connection with the forthcoming arbitration between the city of Kingston, Ont., and the Kingston Light, Heat & Power Company.

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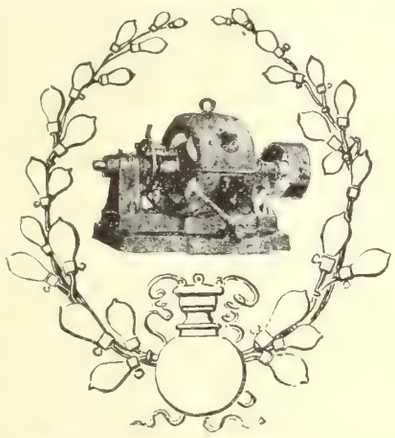
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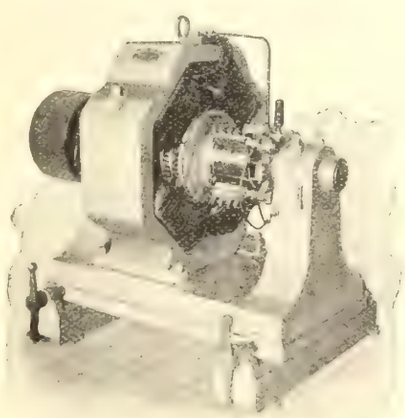
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The Cuisine is excellent. Under the careful management of Mr. S. Daniels, the Windsor has taken a foremost place, and is largely patronized by Members of Parliament, tourists, etc. The rates are $2.00 to $2.50 per day. There is accommodation for 230 guests



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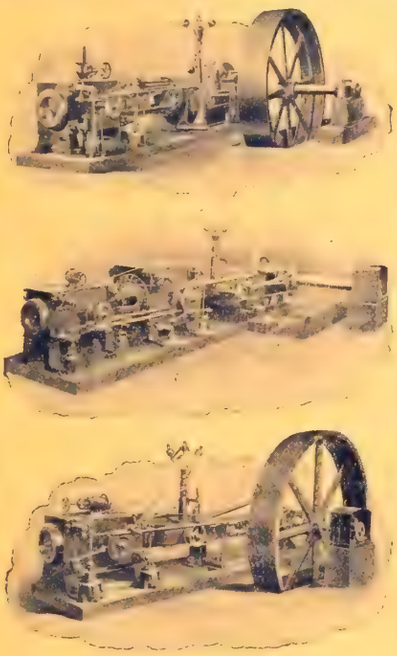
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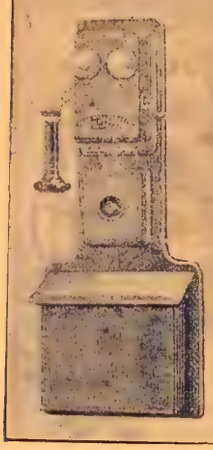
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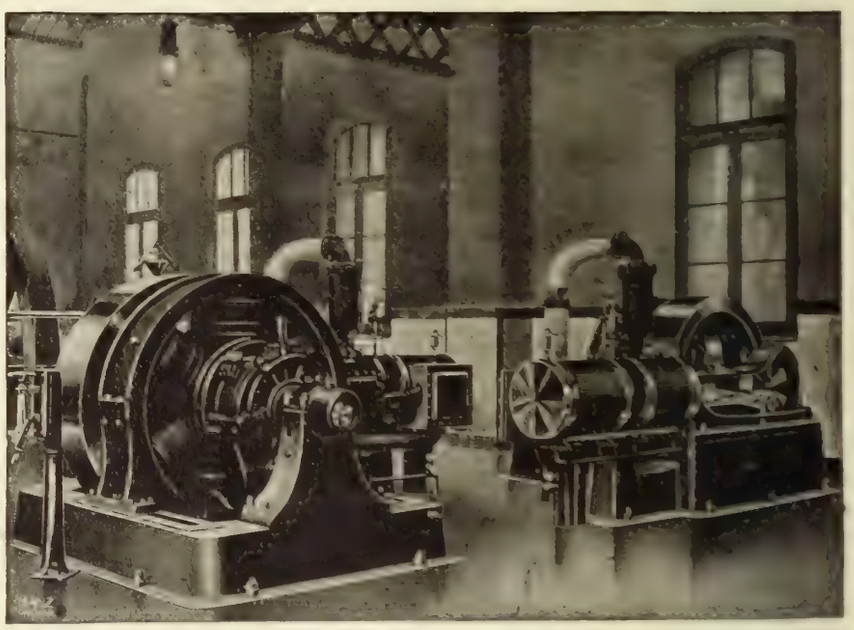
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SPARKS.

The Electric Supply Company, Limited, of Hamilton, is seeking incorporation, capital $30,000. The incorporators include Geo. Lowe, Jos. Farrell and S. B. Bigger.

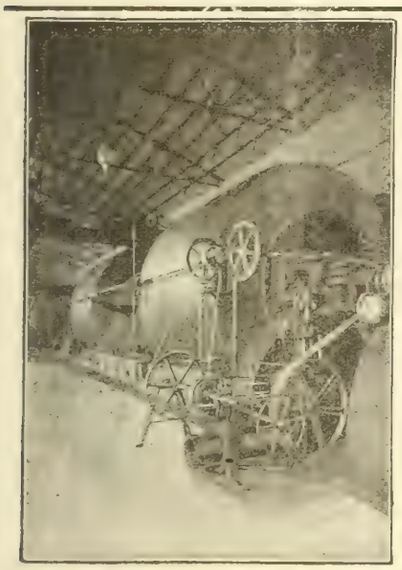
The Canada Brass and Electrical Company, Limited, of Toronto, has been incorporated, to take over the business of J. G. Howarth and A. H. Howarth. The capital is $100,000.

The photograph of the Interprovincial bridge over the Ottawa River, between the cities of Hull and Ottawa, which appeared in our June issue, was furnished by Mr. G. R. Lancefield, photographer, of Ottawa.

Brader Westmore are building the new electric light power house at Dresden, Ont.

A committee of the town council of Mount Forest, Ont., has recommended that the electric light plant of the Mount Forest Electric Light Company be taken over and operated by the corporation.

At the last of the season's monthly meetings of the Insurance Institute, of Montreal, Prof. Ruttan, of McGill University, read an instructive paper on "Spontaneous Combustion," and made some interesting experiments demonstrating certain conditions under which spontaneous ignition takes place.



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THE OTTAWA PUMPING STATION.

One of the most attractive looking places in Ottawa is the city water-works pumping station, a substantial stone structure, the design of which clearly expresses its purpose. The building is surrounded with well kept walks and shrubbery, and in front a fountain of attractive design, sends forth its cooling spray. Inside the building cleanliness and neatness are everywhere apparent in a degree to delight the heart of the visitor interested in mechanics, and to reflect credit upon Mr. Barnes, the courteous and efficient engineer in charge.

The station is equipped with four pumps, each having a capacity of 3,000,000 gallons per 24 hours. These have been in operation for more than twenty years, and are apparently good for as many more years of service. There is also a large pump of later date, the rated capacity of which is 8,000,000 to 10,000,000 gallons per twenty-four hours, but which actually pumps only 5,000,000 to 6,000,000 gallons. All the pumps are operated by turbine wheels, working under a head of 28 feet, the large pump being operated by two wheels of 750 h.p. capacity each.

An addition has recently been built at one end of the building, in which will be installed another pump of 4,000,000 gallons capacity, space remaining for still another, when the increase of population shall demand it. The pumps carry a pressure of 90 to 95 lbs. per square inch at the pumping station, which is increased to 110. lbs in case of fire. The water from these pumps is distributed to all parts of the city through sixty miles of mains. The consumption of water amounts to the high figure of 142 gallons per head of population, as compared with 28 gallons in Glasgow.

LEGAL.

The Appeal Court has sustained the decision of Chief Justice Armour that the rolling stock of an electric railway was real property. Chief Justice Armour held in the case referred to that the rolling stock was an essential part of the railway, the latter being useless without it, and therefore it was real property covered as such by the mortgage, which was involved in the suit. The Court of Appeal supported this view, pointing out that the rolling stock really constituted part of one great machine, confined to a particular locality for which it was specially constructed and fitted. The rails and power house were unquestionably realty, and the rolling stock formed part of it in a much more intimate and connected manner than did the rolling stock of a steam railway. .

Judge McTavish, of Ottawa, and Mr. J. H. Burritt, of Pembroke, have been chosen arbitrators respectively by the Almonte Electric Light Company to value the plant of the company. It is said that they have failed to agree upon a third arbitrator, and that one will be appointed by Judge Senkler. Mr. D. A. Starr, of Montreal, is acting as expert for the town, and Mr. J. J. Ashworth, of Toronto, for the company.

The Public

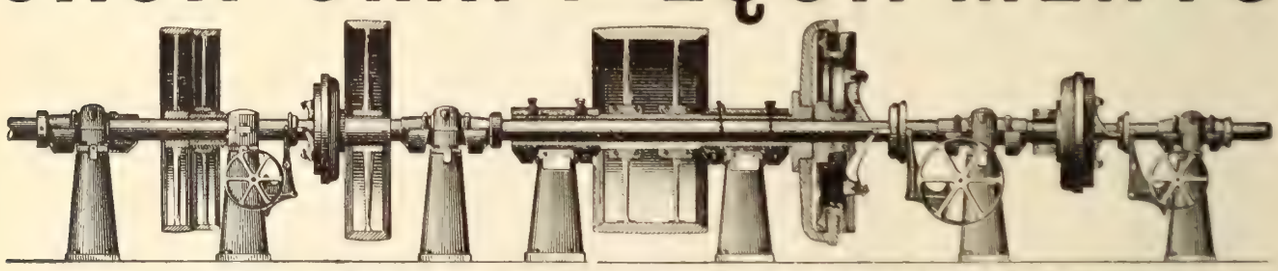
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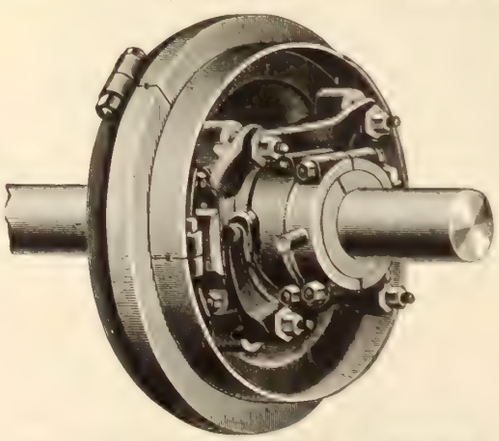
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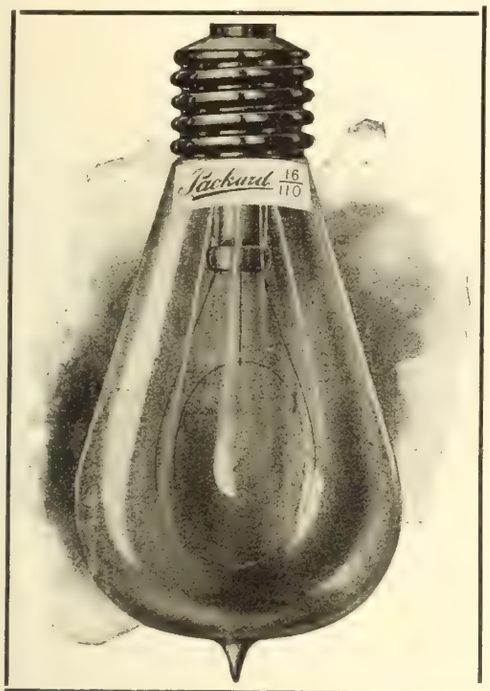
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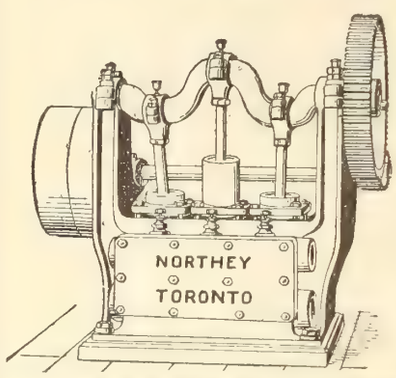
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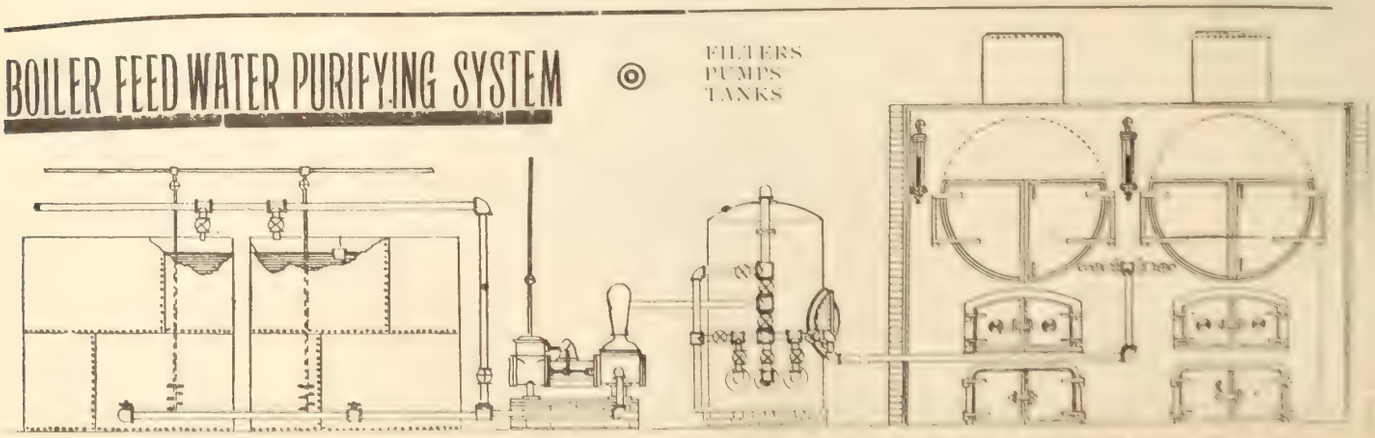
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CANADIAN

ELECTRICAL NEWS

AND

ENGINEERING JOURNAL.

VOL. XI. JULY, 1901 No. 7.

WATER TUBE BOILERS IN THE BRITISH NAVY.

The committee which was appointed by the British Admiralty last year to advise upon the subject of modern types of boilers for the Navy, have recently issued an interim report recommending that further trials be made of four different types of water tube boilers, the Babcock & Wilcox being mentioned first on the list. The committee advise that the Belleville boiler should be discarded for all future ships, already ordered.

The Babcock & Wilcox water tube boiler has been tried for some time in the Navy with very good results and the Admiralty have recently ordered additional Babcock boilers for some of the new ships now building. This type of boiler has been in use by the United States Navy for a number of years with very satisfactory results, and all the new cruisers now authorized by Congress are being fitted with it. Elaborate trials under all conditions have, it is claimed, shown the Babcock marine boiler to be superior in design and construction to other types of water tube boilers, and it seems almost certain that this will be the boiler to be adopted for naval purposes in future. There is every evidence also that, in view of the ever increasing steam pressures required for giving the best economy with engines of large power, this type of boiler is destined before long to entirely supersede the Scotch marine boiler, as one of its special features is the fact that it can be made for any pressure up to 500 pounds per square inch, and will work satisfactorily at this pressure. A large number of these boilers have already been installed in the Mercantile Marine, and we understand the Allan Line have several of them on their ships.



CANADIAN ELECTRICAL ASSOCIATIONCONVENTION, 1901.—GROUP PHOTOGRAPH OF MEMBERS AND VISITORS, ON THE STEPS OF THE PARLIAEENT BUILDINGS, OTTAWA.

NOTES.

After a prolonged discussion upon the tenders submitted for the city ligbting of Montreal, the council decided to call for new tenders in September.

The New York offices of the Manhattan General Construction Co., manufacturers of the Manhattan arc lamp have been removed from 11 Broadway to 120 Broadway.

A new board of directors has recently been appointed by the North Shore Power Co., Three Rivers, P.Q., comprising the following gentlemen: F. F. Farmer, Three Rivers, P.Q., president; E. C. Cresley, Bruthleboro, Vt., vice-president; J. B. Fregeau, Three Rivers, Que., managing director; E. Hargrove, Sherbrooke, Que., secretary-treasurer; Warren Curtis, New York; S. Stevens, Stanstead, Que.

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SUBSCRIPTIONS.

The ELECTRICAL NEWS will be mailed to subscribers in Canada, or the United States, post free, for $1.00 per annum, 50 cents for six months. The price of subscription should be remitted by currency, registered letter, or postal order payable to C. H. Mortimer. Please do not send cheques on local banks unless 25 cents is added for cost of discount. Money sent in unregistered letters will be at senders' risk. Subscriptions from foreign countries embraced in the General Postal Union $1.50 per annum. Subscriptions are payable in advance. The paper will be discontinued at expiration of term paid for if so stipulated by the subscriber, but where no such understanding exists, will be continued until instructions to discontinue are received and all arrearages paid.

Subscribers may have the mailing address changed as often as desired. When ordering change, always give the old as well as the new address.

Subscribers are requested to promptly notify the publishers of failure or delay in the delivery of the paper.

EDITOR'S ANNOUNCEMENTS.

Correspondence is invited upon all topics coming legitimately within the scope of this journal.

The "Canadian Electrical News" has been appointed the official paper of the Canadian Electrical Association.

CANADIAN ELECTRICAL ASSOCIATION.

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PRESIDENT:
P. G. GOSSLER, General Superintendent and Electrical Engineer, Royal Electric Co., Montreal.

1ST VICE-PRESIDENT:
B. F. REESOR, Manager Electric Light & Power Co., Lindsay, Ont.

2ND VICE-PRESIDENT:
EDWARD SLADE, General Superintendent Jacque Cartier Light & Power Co., Quebec.

SECRETARY-TREASURER:
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A. A. DION, Superintendent, Ottawa Electric Co., Ottawa, Ont.
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The C. E. A. Convention.

IN many respects the Convention held at Ottawa last month was the most important meeting since the Association was organized. The attendance exceeded that of any former meeting, and was thoroughly representative of the Provinces of Ontario and Quebec. The papers were of a high order. They received a careful hearing and evoked considerable discussion, and would no doubt have elicited more but for the exhaustive manner in which the subjects were dealt with by the authors.

A wise step has been taken in amending the Constitution to provide for a class of student members. The young men who may be expected to avail themselves of the privilege of student membership are a desirable class, and after graduation will probably apply for full membership and take an active part in the affairs of the Association. Student membership has been established in several of the American Scientific Societies as well as by the Canadian Society of Civil Engineers, with satisfactory results, and there is no reason to doubt that the Canadian Electrical Association will have a similar experience. Another important change in the Constitution is that which provides that persons engaged in the sale of electrical apparatus and supplies shall not in future be eligible to office in the Association. This amendment met with unanimous approval, the consensus of opinion being that the executive management of the Association should be placed excusively in the hands of persons connected with the management and operation of electric light and power, telephone and telegraph companies.

The Convention also gave its hearty approval to the resolution introduced by Mr. Higman which provides that in future the funds of the Association shall not be used for entertainment purposes. The adoption of this resolution does not mean that the annual association banquet shall no longer be a feature of the Conventions, but that those who may desire to participate will be under the necessity of purchasing a ticket. In adopting this rule, the Association is falling into line with other organizations of similar character. A better use will no doubt be found for the Association funds which have hitherto been expended for entertainment.

The admission of about sixty new members at this Convention is an encouraging evidence of growth in popularity and influence. The management for the ensuing year has been placed in experienced and careful though progressive hands, so that the future seems bright with promise. The selection of Quebec as the place of next meeting was made in response to a very cordial invitation from the electrical companies of that city. No doubt there will be a large gathering of the members and their friends to inspect the many interesting sights of the Ancient City which may be seen side by side with some of the most modern developments in electricity. The Quebecers have a reputation for hospitality equal to that of the citizens of Ottawa, which leaves nothing more to be said.

W. C. Hawkins, formerly with the General Electric Company at Schenectady, N.Y., has been appointed general manager of the light and power departments of the Hamilton Electric Light and Cataract Power Company.

Canadian Electrical Association

Proceedings of the Eleventh Convention

THE Eleventh Convention of the Association convened at the Russell House, in the City of Ottawa, on Wednesday, June 19th, 1901, at 10.15 o'clock, a.m., the president Mr. A. A. Dion, in the chair.

The following members registered as being in attendance :

W. H. Browne, P. G. Gossler, F. H. Leonard, jr., Alfred Collyer, R. M. Robertson, G. W. Wright, K. B. Thornton, W. F. Dean, A. G. Grier, Alex. Barrie, Cecil Doutre, Geo. H. Olney, N. A. Stinson, G. R. Duncan, J. A. Douglas, E. E. Cary, W. B. Powell, D. Sleeth, J. A. Burns, R. E. T. Pringle, J. P. Thompson, F. N. Fairman, Fred Thomson, R. B. Owens, J. M. Leamy, A. Milton Smith, Robt. A. Ross, Thos. Rodger, Montreal; Acton Burrows, A. B. Smith, E. D. McCormack, J. W Campbell, H. G. Nicholls, H. A. Moore, Geo. J. Hicks, J. J. Wright, C. H. Mortimer, Wm. L. Aldrich, E. B. Biggar, W. S. McLeish, B. G. McBurney, Wm. McCaffrey, Geo. Angus, F. Nichols, James Kynock, B. F. Selby, Toronto; W. G. Bradley, Ben. Baldwin, T. R. Neville, C. T. Thomson, P. C. Marchaud, John Murphy, C. H. Courselles, Wm. A. McDuff, E. J. O'Reilly, W. Ahearn, D. R. Street, R. Anderson, A. E. Caron, Hector Dion, Geo. F. Macdonald, T. L. Richard, W. B. Morrow, W. Y. Soper, Thos. Ahearn, Ormond Higman, Geo. F. Burk, E. P. Featherstonhaugh, Ottawa; P. H. Hoover, Mr. Bliven, New York; R. B. Hamilton, G. A. Powell, S Catharines; F. W. Martin, W. J. McLaren, Hamilton, Ont.; R. J. Smith, Perth, Ont.; V.B. Coleman, Port Hope, Ont.; J. A. Robertson, Vankleek Hill, Ont.; H. B. Kirkland, Chelsea, Mass.; H. O. Fisk, Peterborough, Ont.; A. Sangster, R. N. Robins, Sherbrooke, Que.; Frank Houghton, Cleveland, O.; Geo. U. G. Holman, L. Denis, Quebec City; L. H. Reesor, St. Mary's; J. E. Skidmore, Cobourg ; B. F. Reesor, Thos. Sadler, Lindsay; E. S. Reynolds, Philadelphia; G. L. Kitchen, Newmarket; J. M. Brown, Carleton Place; E. J. Kely, Merrickville; W. R. Taylor, Aylmer, Que.; J. W. Purcell, Walkerville; John Yule, Guelph; W. A. Layman, St. Louis, U.S.A.; D. A. Starr, Cornwall; A. S. Carswell, Pakenham; Raoul Girouard, Smith's Falls.

The President, Mr. A. A. Dion, in opening the Convention, said:

Gentlemen, the programme for this morning was to be a civic welcome by the Mayor of Ottawa. Owing to the fact that several members will not reach the city until the noon train it was thought advisable to postpone the welcome from the city until the opening of the afternoon session at 2.15. This was agreeable to the city authorities and it is arranged to do that. I would advise you, however, to be here pretty sharp on time this afternoon at 2.15 so as not to disappoint the Mayor and other aldermen of the Reception Committee of the City Council who will be here to greet you.

An unfortunate mistake was made in expressing the papers of the Secretary-Treasurer from Toronto by the Canadian Express Co. instead of the Dominion Express Co., consequently they will not be here until about eleven o'clock, so that he has not got the register of the members or his minute book or report. Nevertheless I thought it would be too bad to lose the whole morning, and we might skip these items on the order of business and go on with other matters filling in the morning, so that at the opening of the afternoon session we could go on with these things which we will have to lay aside this morning.

The second item on the programme is an address by the President of the Association. I may say, gentlemen, that this was put on the programme in accordance with a custom which has held in this Association that the President should make a formal address at the opening of the Convention. I may say it is not my purpose this year to take up your time with any formal address. This address which usually covers the progress of electrical science and industry throughout Canada during the past year, loses considerable of its value from the fact that all these items recording the progress of science and industry in this country are regularly reported in the lay and technical press and we are all familiar with them, so that any review which I might make would only be a repetition of something you have already read or heard I may say, however, that I am exceedingly pleased to meet so many of you in this my own city toattend the Electrical Convention. Last year on account of the fire which had taken place the convention was removed to another place to my great regret, and I am only too glad that I am now given an opportunity to redeem the promise we had made before of giving you a reception in our own city. The programme will show you that some little entertainment has been provided for you. We have tried to arrange it so as to fill in the leisure time and not to interfere with the business portion of the convention. I trust when you go away from this city you will carry with you very pleasant memories of your sojourn here.

The list of papers which you have before you is a very interesting one, and I trust these will receive very full discussion at your hands. It was desired, as in former years, to have these papers printed and placed in your hands sometime before the opening of this meeting in order that you might make yourselves familiar with them and come prepared to discuss them. I can say for Mr. Gossler, the Chairman of the Committee on Papers, that he has used every possible effort to have that done, but it is a very difficult task. It was almost impossible to get a manuscript from those who prepared them in time ; the result was the papers were placed in print at eight o'clock last evening, so that if we have them here printed at all it is due to the diligence of Mr. Mortimer, as they reached him only at that late hour.

Some of the papers are very timely and I would like them specially discussed. One of the papers refers to rates for electric light. This is not a new subject, but one of increasing importance. Another subject for discussion is also on the same lines, as to the best system of charging for induction motors. It is evident that some of the older plans of charging for electric light and power are often cumbrous and not equitable in every sense, and there has been a desire during the last few years on the part of electric companies throughout America to devise systems of charging which would be equitable both to the supply company and to the consumer A great deal has been written and several papers have been read in other societies on this subject, and I am glad to say that we will have some discussion on the matter. It is a thing that everybody can speak on and I trust will be fully discussed, so that we may all gather some valuable information from our meeting.

I declare this meeting now open for business and I trust we will have a full attendance at all the sessions. The next item is the reading of the minutes, which will have to be dispensed with for the reasons I have given, also the report of the Secretary. The next item will be the reports of committees.

Mr. J. J. Wright, on behalf of the Chairman, Mr. R. O. McCullough, presented the report of the Legislative Committee, as follows:

REPORT OF LEGISLATIVE COMMITTEE.

Gentlemen:—Since your convention of last year, the Legislative Committee has had its hands pretty full. While no direct attack was made on what is generally known as the Conmee Act, the City of Toronto introduced

a bill to be relieved from its provisions, and after much discussion in regard to the construction of a private act of the Consumers' Gas Company and its conflict with the Conmee Act, an Act was passed, the practical effect of which is to provide that the Municipality of Toronto is not within the provisions of the Conmee Act, as far as the Consumers' Gas Company is concerned or the establishment of a municipal gas plant within the municipality. It was feared that the introduction of this bill by the City of Toronto would lead to a reconsideration of the principles of the Conmee Act, and accordingly such steps as were thought necessary to protect these principles were taken with favorable results.

The most important matter your committee had to deal with was the assessment question. As you are aware, since what is known as the Scrap Iron Decision, there has been constant agitation on the part of various municipalities in the Province for the introduction of an Act to repeal the Assessment Law and enact such legislation as became necessary to do away with the effect of this decision, and the Provincial Government recognizing the justice of this, appointed a Commission to deal with the whole question of assessment. It was thought advisable that this Association should be represented before the Assessment Commission by Counsel so that the case of the Electric Light Companies should be properly presented to the Commission. Mr. W. M. Douglas, K.C., of Toronto, was retained by your Committee and attended at the several sessions of the Commission. Your interests were well and carefully attended to and your case fairly and properly presented to the Commission, at a comparatively small cost. It may be stated here that electric light companies do not object and have never objected to a fair taxation, and so far as the Committe is aware, no electric light company has taken advantage or sought to ava;l itself in any way of the Scrap Iron Decision. The Assessment Commission, finding itself unable to conclude its inquiries on the general question of assessment in time to make its report to the Legislature in session, made an interim report to the Government, dealing with the assessment of companies having franchises or quasi franchises from Municipal Corporations. It recommended the enactment of a law providing that all the property of such companies shall be taxed first on the value of the land and then on the value of the buildings or works thereon, on a basis of the cost of their reproduction, all wires, poles, gas mains or other property of the company being included. The Government then introduced a bill to repeal the Act on which the Scrap Iron Decision was based, and also at the same time, a..other bill with a measure of relief to the companied affected, but when the matter was discussed in Parliament, it was lound to be larger question than at first considered and was left over until the next session, and both these bill. were withdrawn.

The Assessment matter then is practically in the same position as formerly, with this exception, however, that it is certain to be dealt with fully at the next session of the Legislature. Your Committee feels that it would be a great hardship, especially on small companies, to be taxed to the limit on a basis of cost of reproduction, that no reasonable objection should be made to taxation based on the gross revenue of the company or totaxation on the value of the plant and works in the same proportion as other manufacturing plants in the same municipality. It will be necessary for the Association to take active measures for the proper presentation of its views to the Government and also the Assessment Commission, and I believe it is right for the Committee to state here that considering the very important work carried on by this Committee and the incalculable benefit derived from its work by the various electrical companies belonging to this Association, and the unselfish and arduous labors of the members of the Committee at their own expense, that the campanies interested do not and have not properly supported the Committee financially. At your convention last year, a motion was carried referring the matter of raising money for legislative purposes to the Executive and Legislative Committees. These Committees met and engaged a canvasser in the employ of Mr. Mortimer at fixed charge per company visited, but the results obtained were to say the least very disappointing. The total amount raised during the year was $253.00, which after deducting last year's deficit of $32.86 left $220.14. The expenses for the year have not been large. They amount to $227.86, which leaves a deficit of $7.72. The disbursements are as follows:

For telegrams, postage, stationery, printing exchange, services of canvasser, etc	47.51
For legal services	180.35
Total	$227.86

The number of companies and individuals who have contributed this year is 23; last year the number was 76. The names of the contributors are as follows :

Trenton Electric Co., Renfrew Electric Co., Strathroy Electric Co., Knight Bros. Co., Burk's Falls; James Playfair, Midland; W. H. Birchard, Aurora; Smith Fall's Electric Co, Hamilton & Prout, Forest; Henry Cook, Hensall; Wingham Electric Co., Merrickville Electric Light Co., Ottawa Electric Co., R. A. Corbett, Port Hope; Brantford Electric & Operating Co., Guelph Light & Power Co., Citizens Telephone & Electric Co., Rat Portage; Ingersoll Electric Co., Ga,t Gas Light Co., Petrolia Elecêric Light Co., Gananoque Electric Light Co., Wm. Moore & Son, Meaford; St. Thomas Gas Co., Jos. Knox, Stayner.

Your Committee desires to urge the absolute necessity of greater financial assistance, as the work next year is of the greatest importance. It is reasonably certain that some effort will be made against the Conmee Act and the Assessment question demands your earnest, undivided and unceasing attention. It is unfortunate that so important a question as that of assessment should come before the House at the last session of the existing Parliament, as the members may be influenced in their deliberations by the prevailing antagonism to corporations. This leads your Committee to again emphasize the importance of this question and the desirability that the companies should take immediate action towards protecting their rights, in some measure at least.

Your Committee desire to express their acknowledgement to these who have so ably and generously assisted in protecting at their own expense the rights and interests of the companies.

R. O. McCulloch,
Chairman Committee on Legislation.

The President : The report is before you, gentlemen, for consideration. The Committee has raised an important question, that of furnishing adequate support to the Legislative Committee for the carrying on of its important labors, and I think it is a matter that oughttobe dealt with. If anyone has any explanation to offer or any reasons to give, or any suggestions to make as to a better way of handling this subject we would be very pleased to hear from them. It is certain that the Legis this year, andnextyear must be cintinued as q permanent nent committee to watch our interests, and they must have ways and means. If the means they have adopted so far have not been adequate we should discuss some other way of getting them. The Legislative Committee are doing our work collectively in a better way than we can do it individually, and this matter should be fairly considered.

Mr. John Yule : The situation at present in Ontario in regard to the interest of the lighting companies is very serious. The next session of the Legislature is the last session. It practically amounts to an election campaign, and there is great danger of the Opposition taking up the cry and making it a part of their platform that the present Government has been the creature of the corporations, which it has not been. This report is very full, but it does not embody a quarter of the work that has been done. Every member of the Committee has been at a large financial outlay that is not charged to the funds subscribed at all. I am so much disgusted with the support we got from the companies that I feel like dropping the thing and letting them take care of themselves; and if the members of the Committee were to leave the whole

thing alone severely for a year or two we would be back in a worse position than we were before. I claim our labors have been of great financial value to the companies of Ontario. You know how many companies have been bought out, after arbitration, and these simply represent the amout of money that has been paid by municipalities to those companies. If we had not succeeded in getting our interests properly represented before the Government every company that has been transferred would simply have been wiped out. The feeling of the municipalities and average aldermen is that they should put in their own plant and go into competition with the existing companies. I donjt know that I can say enough to impress upon the companies the importance of this thing and of continually watching and guarding. If they only knew what work we have done they would look at the thing in a proper and more liberal spirit.

Mr. B. F. Reesor: Mr. President, I don't know that I can add very much to what Mr. Yule has just said. I am as satisfied in my own mind as I am satisfied of anything that had it not been for the Conmee Bill passed and in existence to-day, every company or individual that has been in the electric light business and has been bought out by a corporation would not have been bought out, but would have dropped out of place, would have been swamped and ruined. As far as our town is concerned, we feel that very keenly. We are in probably a unique position; we have not had any street lighting for almost a year. There has been a fight going on there ever since and we are satisfied that had it not been for the Conmee Bill we would have had the opposition of the corporation; the corporation would have gone into lighting on their own account. As it is now, we are sustained by the Conmee Act and we are in that position that before the corporation can go into lighting on their own account they have got to buy us out. I don't think they propose to buy us out at all, but at the same time that is the position we would have been in, and we would have had a corporation plant put in there and our plant thrown in the scrap pile; and I feel, as a member of the Legislation Committee, very keenly that we have not been supported by the electric companies and those interested the way we should have been. There is nothing for it that I can see other than to go on in the way we have been going. I can't conceive any better way of raising and devising ways and means for subscribing than the way it has been done. If any member of the Association can suggest something better I would be pleased to hear it.

Mr. W. H. Browne: Mr. President, I have somewhat arrived at the impression that the efforts of the canvassing committee for the procuring of funds for the Legislative Committee for the past year, have been confined largely to the companies in Ontario only, and they have seemed to treat this matter as an Ontario one. I find in looking over the report of last year that Mr. Yule's idea was that a canvasser be engaged to visit all the companies and get them to sign an agreement to contribute a specific amount for five years. I am not aware that that suggestion has been acted upon. We in Quebec, although not menaced by the same spirit that seemed to prevail prior to the passage of the Conmee Act, must necessarily anticipate in the future legislation of some kind; and I presume it would extend to other portions of the Dominion as well, and we certainly should not be left out for contributions to this fund. I may say the Royal has been ready to do its part.

Mr. John Yule: There was one company which came into Canada, an American company, whose interests in Canada are not at present affected at all, but they very generously, and with a good deal of foresight, said, "we are not affected at present, but we can see if this thing is going to go on it will not be long before we are affected, and we are prepared to support you in your fight." It seems galling to me that people that have received the benefits of our work never even gave us a dollar or wrote us a letter. As to the agreement, it was decided to call for it for three years instead of five We thought five years was too long ahead and we made an effort to get a three years' agreement. I would ask the Secretary have all those who signed the agreement paid the draft that was sent out for the assessment?

Mr. C. H. Mortimer: I think so, as far as I know. Where drafts have been made they have been paid. The draft was only made for one year's assessment. I think the great majorityof them paid the drafts.

Mr. B. F. Reesor: This canvass that was spoken about in the last year's report was not made, was it?

Mr. Mortimer: Western Ontario was pretty thoroughly canvassed; and when the canvasser started out again this year I asked Mr. McCullough if we should continue that work, and Mr. McCullough said no, so that nothing has been done in Eastern Ontario.

Mr. J. J. Wright moved, seconded by Mr. B. F. Reesor, that the report of the Committee on Legislation be adopted. Carried.

The President: The Committee on Standardization of Accounts, of which Mr. Hart was chairman, and which committee exists for two years, had done some work in the first year and obtained some additional data during the last year from which Mr. Hart was to prepare a report to submit to this meeting. Mr. Hart is not here this morning; he may be here later, and as there are other committees to report, we might possibly have a report from the Standardization Committee at a later session.

The President called for the report of the Committee on Rating of Arc Lamps.

Mr. O. Higman: There has been no meeting of the Committee. The understanding was that as arc lighting was at that moment in a transitory state we should delay action in the matter of a standard until some future time.

I might say that during the last session an amendment was made to the Act giving power to create a standard for arc lighting, and if this Committee is continued they can get to work now, with the assistance of the Department, and make such standards as they deem necessary.

The President appointed as the Nominating Committee to strike the standing committees for the coming year, Messrs. W. H. Browne, Montreal; J. J. Wright, Toronto; and Mr. B. F. Reesor, Lindsay; with instructions to report to-morrow as to the standing committees for the year.

The President: The next item will be the reading and discussion of papers.

Mr. K. B. Thornton, Montreal, read his paper on "Notes on Construction and Protection of Aerial Transmission Lines," which was greeted with applause. (See page 142.)

The President: You have heard a very able and interesting paper on a very practical subject, and treated in a very practical way—the kind of paper that many members of this Association have been asking for. I think we are indebted very much to Mr. Thornton for presenting it and treating the subject in such a complete manner. It is now open for discussion and I hope it will receive a very full consideration.

Mr. W. H. Browne: Mr. Thornton has treated this subject practically and well. I hope, however, it will not be allowed to drop without submitting him to some questioning as to further light wanted upon it.

Mr. B. F. Reesor: I do not think it is fair that this paper should be presented without discussion. For myself, I feel very highly complimented in the way the paper has been gotten up; I fancy Mr. Thornton must have been over our transmission line (laughter). Our transmission line is carried out to the letter, almost in accordance with Mr. Thornton's ideas, with perhaps one or two exceptions. He speaks of a rubber covered wire. Our transmission line, which is fourteen miles long, is a bare wire. In another place he speaks of barb wire on the cross-arm; we have not got barb wire on the outside of the cross-arm, we have it on the top of the pole, but it is put on with staples instead of an insulator; and then where he grounds every pole we ground every other pole, and we have fifty-six poles to the mile. I am a little opposed to the barb wire lightning arrestor for the reason, perhaps, that there is a danger of the barb wire dragging or breaking and getting tangled up with the

live wire, although we have had no difficulty whatever so far, neither have we had any difficulty with lightning discharges. Those we have had, have been taken care of; whether the barb wire has done this or not, we do not know, but we will give the barb wire the credit. Otherwise I think the line Mr. Thornton builds, mentioned in his paper, is one of probably as good construction as could possibly be put up. I think the depth of the holes and the poles are about uniform with what we have been using. The size of our poles is seven to eight inches at the top; and five feet was our standard for depth of hole. We guyed our poles at every turn and then guyed endwise at short distances as well. On our line we have a metallic circuit telephone line under the transmission line. We transpose the telephone line every fifth pole and it has given us eminent satisfaction. The induction is nil. We can talk over fourteen miles without any difficulty; it is simply perfect. Our voltage transmission is 10,000 volts. I hope this paper will be fully discussed.

Mr. P. G. Gossler: It is particularly interesting to me to hear Mr. Reesor's experience with his barb wire protection. I think it would be very beneficial and certainly instructive to hear the result of the experience in other plants. The experience we have had on the Chambly line has been exceedingly satisfactory, and I think demonstrates clearly the safe-guard that barb wire as a lightning protection affords. When our line was first constructed it was intended to have the ordinary air gap arresters located at each place where aerial lines were connected with the cable, as it has been shown in a great many cases that there is liable to be trouble where aerial lines are connected with underground cables. This was not done as the arresters were not available in time and the line was put into use without them; we therefore anticipated considerable trouble at the points in the transmission lines, where the aerial and underground systems joined. The first storm that came along, came about midnight, and I think we were all pretty well scared because we expected to see the cables break down; the barb wire, however, fixed that, and we ran one entire summer, through a season when, according to the records of McGill College there were more storms than for three years together for the past seven years. Since that time it was thought inadvisable to place air gap lightning arresters where the aerial and cable sections joined, inasmuch as they would necessarily be some distance from the station and not under constant observation. I should like very much to hear the experience of other companies in connection with the barb wire protection.

Mr. F. W. Martin: In Hamilton we have a 22,000 volts transmission and we have run the best part of this summer without the lightning arresters on at all. It is a question with us whether it would be advisable to put the air gap lightning arrestor on. We have had storms up there, and didn't know whether it would be any improvement to put them on or not, in fact, my own idea would be to leave the air gap lightning arresters off.

Mr. P. G. Gossler: About six weeks after we put the transmission line into use there was one very severe storm which occurred early in the evening when we could see the storm travelling. The storm struck Montreal first and simply demoralized the local distribution system, and then started in a direction due east, which would be right towards Chambly, following along our main transmission line. We were fortunate enough to not have our telephone communication interrupted, and followed the progress of the storm till it got to Chambly. When it got there, there were several local lines which were simply paralyzed and all the transformers destroyed; however, during that entire storm, possibly covering an hour, there was not a single discharge on the 34 miles of transmission line. That seemed to us almost conclusive—it was conclusive evidence of the protection afforded by barb wire, and as shewn on those lines was a very reliable safeguard. I may say for the three seasons that line has been in use there has never been a single discharge on the line or any interruption whatever.

Mr. B. F. Reesor: We have a six inch plate soldered to every ground wire at the bottom of the pole; and we have on our high voltage line air gap arresters at each end; we have repeatedly seen during a heavy storm a discharge going through these air gaps; at the same time our experience has been that while storms were going on and our local lines were punctured and broken down our transmission line was not affected in any way.

Mr. W. H. Browne: The paper and the discussion seems to have drifted to transmission lines. I would like to arouse questions and discussion upon the internal distributing lines within our towns and cities. That, it seems to me, is one of the most important features of our business. The transmission line question, I think, has been practically taken care of. How are we acting in our local distribution work within the cities? How are we making our connections to our customers premises? How are we avoiding the dangers from lightning discharges and crossings and other things? I would like to arouse some discussion and some question on that line.

Mr. Campbell: I think this gentleman deserves to be congratulated for the very important paper he has presented, and as a suggestion I would think it would be wise to have that paper published and handed to every electrical company in the country for the benefit of their engineers at large. While I do not wish to prolong the discussion on transmission lines, there was one point I wished to refer to, and that was barb wire as used on the very large transmission lines, take the line from Niagara Falls to Buffalo. I understand that they used barb wire originally and abandoned it. Mr. Thornton speaks in his paper about some engineers taking exception to the use of barb wire. He probably has a reason for making that remark, and I would like to have an explanation from him as to what information he has on it. The paper as a whole is a very important one and one which is undoubtedly useful to everyone connected with the Association.

Mr. O. Higman: Mr. Thornton is certainly entitled to our thanks for the very able paper he has given on this subject. There is just one feature connected with the line that I would refer to, and that is the grounding of the poles as a protection from lightning. At least 30 years ago the International Electric Company of Great Britain, when building their line, invariably placed a ground wire on every alternate pole, and it was a most unusual thing to see a pole destroyed by lightning. In this country where there has been no such practice I have known as many as ten or twelve poles consecutively destroyed, splintered by lightning. Mr. Smith will bear me out in this.

Mr. A. B. Smith: That was in the old days.

Mr. Higman: It was only a few years ago it was not the practice to ground poles. I think it is an excellent method of protecting the poles from destruction by lightning.

Mr. H. A. Moore: I would like to ask if any of the members have the data in connection with the use of any other wire than barb wire in particular as a protection to the lines? The big objection to the use of barb wire seems to be its lack of good mechanical properties and its liability to corrosion, and the generally poor quality of the iron in barb wire. I was connected with a company for a few years which operated a transmission line and a distributing line as well, and on the local distribution circuits the arc circuit paralleled or ran above the distributing circuit nearly all over the town. In four years there were only one or two discharges through the arresters on the alternating circuit, but during every lightning storm which visited the locality the arresters on the arc circuit went off repeatedly at almost every discharge. I would like to know if any of the other members have had experiences along similar lines, and whether it is not possible that an iron wire or a wire of some other metal of far better mechanical properties than barb wire could not be used as a lightning protection.

The President: This discussion is very interesting. I came here with the impression that barb wire as a protection for transmission lines was not, to use a common expression, what it is cracked up to be. I have read of

several instances where it was said that barb wire was breaking frequently and causing line troubles, had become such a nuisance it had to be abandoned. I am very glad to hear from others here to-day that barb wire is an effective protection against lightning and that the line troubles through its use have been exaggerated. From the evidence we have heard here to-day I would think the protection of long distance transmission from lightning was pretty well solved. There is that very important point raised by Mr. Browne, the protection of internal distribution lines throughout the city, which is not solved. This is a good subject for discussion, as to whether the advantages of the barb wire system can be extended to city lines. If the trouble due to breakage is so great as to prevent the use of barb wire throughout the streets, then why not, as suggested by Mr. Moore, get some substitute, a steel wire or some wire that can be depended upon to stand as much strain as your ordinary wire; then it would seem we might get a more effective protection than we get now. The protection from air gap lightning arresters placed at the station end of the line, in connection with choke coils and supplemented by air gap lightning arresters on other points on the distribution lines, are not an effective protection against lightning. That is the teaching of experience. The station apparatus, to my experience, is pretty well protected, but the transformers are not. Now, it is a very live question and a question which means dollars and cents to all of us as to how to better protect our transformers in the city from lightning discharges; and if we can evolve a system of continuous lightning protection free from the defects which have been charged against the barb wire, we will have done a very important service to all electrical companies in the country. Another point which I took note of is the excellent specification given by Mr. Thornton for the construction of lines. We all see very bad line construction through cities and towns, and I have no doubt that the men who put those lines up are quite capable of putting up good lines if they were only told how to do it, and I think if a specification like this were placed in the hands of all people responsible for building lines there would be a vast improvement in line construction.

Mr. Yule: I would make the suggestion that Mr. Mortimer publish this paper in the shape of a pamphlet and sell it at a small charge.

Mr. J. J. Wright: With reference to using another wire for that purpose, it seems to me that is a very small matter. The barb itself appears to be an essential part in the use of that wire. A plain wire without the barb would not be nearly as effective; but if it is found that the use of this barb wire is effective the balance of the question is a simple one; it is merely a question of a little more money. The only reason why this barb wire has been found to be so effective is simply because it is the every day barb wire of commerce, what the farmer uses to keep his sheep out of the pasture field; it is not intended for this purpose. If it is found that it is a perfect protection it is simply a matter of getting a heavier steel wire or even a copper wire or any other metal that is able to stand the strain. Mr. Browne's query as to the protection of city lines is fully as important as the other. We have no means of protection. We have tried every kind of lightning arresters, yet the only thing we can do is to keep a stock of transformers, and when one goes put up another in place of it.

Mr. Martin: In Hamilton we have tried putting the lightning arresters on the ends of all our lines as well as in the station.

Mr. H. O. Fisk: It seems it would be a good scheme to ground quite a number of these poles that our linemen have to be travelling up and down every day and doing work on, especially in wet weather? It would be rather warm there I fancy at times.

Mr. O. Higman: An idea suggests itself to me. A steel wire might be made with a ragged edge that would take the place of the bit of wire that is tied around, which must be ineffective.

Mr. Martin: Wouldn't it, with the grounded wire, be safer for the linemen?

Mr. A. B. Smith: I want to say that I think this convention ought not to degenerate into a barb wire convention, but I want to say a good thing for barb wire. I remember distinctly a few years ago a terrific storm we had in Western Ontario, extending chiefly from Hamilton to Niagara Falls, and during the night everything in the shape of a telegraph and telephone iron wire went down. The Cataract Power Company's transmission line on the other side of the railway track carried these barb wire arresters with the transmission wire and telephone wires below, and it was a remarkable fact that there was not an atom of sleet on the barb wire, while the other wires were loaded. There is something in that that is worth considering.

Mr. B. F. Reesor: We have no trouble with barb wire, the only objection I have to it is that when it breaks it goes into about forty kinks.

Mr. Martin: Has Mr. Reesor had much trouble with the breaking of the barb wire?

Mr. Reesor: No trouble whatever.

Mr. Martin: I only remember one instance in Hamilton. The barb wire dropped down clear of everything and we only had to cut it out. It didn't stop the service.

Mr. Gossler: I would like to make a reply to Mr. Moore's enquiry for any other companies who have had experiences on their lines in regard to arc wires taking off discharges. We have noticed on our lines throughout the city that there have been more discharges on the lines on the upper portions of the poles. In regard to protection within the city, we are at present making an experiment, and had hoped to have some results ready for this convention. Fortunately, or unfortunately, there have been no lightning storms of any consequence within the last six weeks. We are protecting one circuit in the city by means of the barb wire, and another circuit by means of the air gap lightning arresters. If we have any results before the convention next year which are worth relating we will let you have the benefit of them. In regard to the grounding of the ground wire on the pole, if that was carried out in city construction, and carried to the top of the pole, as it has been in some instances, it would not be safe. It would be unsafe for the men to work. The means of connecting the barb wires to the ground wire as shown in Mr. Thornton's paper I think will do away with any difficulty to be experienced in that way. The ground wire is on the outside of the crossarms and is taken down far enough on the pole so that a man sitting on a brace or cross-arm will not likely come in contact with it.

Mr. Campbell: May I ask Mr. Thornton if he could give any information on that question as to why certain people have discarded the use of barb wire?

Mr. Thornton: I believe that the use of barb wire has been abandoned on the Buffalo-Niagara line, at least it was noted in some of the electrical papers. Their exact reasons for doing so I don't know, but judging from our own experience I should think it is probably due to defective construction in putting the barb wire up. If it is inspected every now and then I think that trouble can be forestalled. We made a minute inspection this year and found where our barb wires crossed over the railway tracks there was some sign of deterioration due to the smoke of the locomotives acting upon the zinc; we simply cut out these stretches and on the whole of the rest of the transmission line there was not the slightest sign of any deterioration or anything we needed to be afraid of. In regard to trouble in winter, last year we had an extremely severe winter in Montreal; and although we had one of our seventy-foot pole lines in the city blown down, we had no trouble at all with the barb wires being broken by sleet or anything else. Mr. Reesor spoke with reference to the telephone line. Our telephone line is below the transmission line, it is not shown on the sketch in my paper. It is hard drawn No. 12, B. & S. copper wire [illegible] We have a [illegible] system with somewhere about ten telephones connected with it

and we have no trouble with hearing on the line at all, as the wires are " spun " throughout the entire distance from Chambly to Montreal. We have found with lightning storms that the city is affected in the extremities. A short time ago I plotted out on a map the transformers that were burned out and it showed they were all in bunches in certain sections; they were at the extremities of the lines to the east and west, but in the centre of the city we had very little trouble at all. In the east end of the city we are putting up barb wire on one circuit that runs some considerable distance from the power house. In regard to protecting the grounding wire, we have recently protected it by running a wooden moulding up the pole. As far as the transmission line is concerned, our men do not ordinarily work on it when it is alive; but in the city it is a different thing; we always work on the lines when alive so that the presence of any ground wire is more or less of a menace.

The President : Have you any theory for the occurrence of lightning discharges on the outskirts of the city rather than in the city ?

Mr. Thornton : I think it is a well-known fact that the greater strain during a lightning storm is at the ends of transmission lines, that is where we experience most of our trouble, for that reason I said the arresters should always be put at the ends of the lines.

Mr. W. H. Browne : May it not be the fact that the presence in large numbers in the congested portions of the city, of telegraph and telephone wires, which are usually above the electric light wires, may have the same effect in the distribution of lightning discharges as barb wire would on the poles themselves ?

Mr. Thornton : I don't think there is any doubt at all that the presence of grounded lines and that sort of thing in the city must be more or less of a protection to lines in the immediate vicinity, and for that reason I think we suffer less in the city. I omitted mention that wherever we guyed to other companies poles or to guy poles we put a strain insulator on every guy. With regard to the men doing line work in the city, there is no doubt about it if you leave them to their own sweet will they will do about the worst work it is possible for them to do. Recently we have been paying a good deal more attention to our line work and have found it advisable to have a good man who will stay right by the gang and instruct them how to do decent work. In regard to Mr. Browne's remarks, I purposely left out the matter of house connections and that sort of thing. That in itself is a large subject and needs almost a paper in itself. It is a difficult job in some cases to make nice work in house connections, especially as it is the practice now for all people in Montreal at least, to wire their houses to the rear, while the poles are on the street, making it necessary to cross over the roofs of houses. In building lines in the city you have got to protect your lines and to put them up in such a way that you will not have crosses between your primary and secondary circuits, and that your primary and secondary wires wont be grounded together on trees. Where other companies are operating in the same city and in the same locality you have got to use additional precautions in order to avoid any chance of trouble. You have got to patrol your lines. We keep one special inspector who patrols our lines day in and day out; and I think the other companies as far as I know all have a special man detailed to do the same work. Although we occasionally have line troubles I think a great many of them are forestalled by this inspector going around and reporting defects and the repairs being made at once before anything serious develops.

The President : It occurred to me while Mr. Thornton spoke of the difficulties of connecting house wires from the rear to a line that is on the street, that it was a very great difficulty that we have all experienced more or less. I would like to know what the practice is in Montreal in regard to that, whether you allow a man to wire any way he likes and you connect with the house no matter where the entrance is, or whether you object to certain ways of making connections, such as going over roofs and so forth.

Mr. Thornton : If a man asks for the rear we connect at the rear. If we didn't the other company would, I suppose. That is where poor line work comes in. You leave it to the ingenuity of the foreman to dodge around chimneys and get over roofs; and some of the roofs are particularly hard to get over. In most of the streets in Montreal the blocks are divided with a lane up the centre. Very often on your nerve you can put poles up a lane, or you can get permission from the proprietors to put poles in the lanes. In that way we can connect from the rear. In some cases we have had to do that; it was simply impossible to connect them from the front. In some cases to avoid interfering with any other company's line we do go considerably out of our way to avoid crossing their wires, and connect to the customers premises. We do not follow any special rule for connecting a customer's premises. It is almost necessary in every single instance to send a foreman and see what is necessary. We thought with our records we could look up and determine the exact position of the customer relatively to our poles and distribution systems and say, you need so much wire; but we found we could not do that. It is necessary to send the foreman and see what is necessary. Nearly all contractors are wiring to the rear, especially in residential sections.

The President : If there is no more discussion I think I will voice your sentiments in tendering the thanks of the Association to Mr. Thornton for the great pains he has taken in preparing this paper. It is a very valuable contribution to the records of the Association.

The President read a telegram from Mr. F. Simmons, of Kingston, regretting his inability to attend the convention on account of the strike in that city.

At 12 o'clock, noon, Mr. J. J. Wright moved, seconded by Mr. John Yule, that this meeting adjourn to 2.15 o'clock p.m. Carried.

AFTERNOON SESSION.

The President in the chair, called the Convention to order, at 2.15 o'clock.

A telegram was read from Mr. Edward Slade, stating he had been detained by urgent business, but would be with the Convention on Thursday; also a telegram from Prof. Owens, stating he would not be able to be present to-day, and asking that the reading of his paper be postponed until Thursday afternoon.

The President: Gentlemen, it is our privilege to have with us this afternoon His Worship, Mayor Morris, of Ottawa, and Alderman Deering, Chairman of the Civic Reception Committee, who have been kind enough to come down here to greet you as members of the Canadian Electrical Association. I will call upon His Worship to address a few words to you as Mayor of the City of Ottawa. (Applause.)

Mayor Morris: Mr. President and Gentlemen of the Canadian Electrical Association: I was just beginning to wonder if the Electrical Association was responsible for the electrical storm which has just passed over the city, and if so I think it is a very opportune time for gentlemen who are interested in manufacturing to start a barb-wire factory here (laughter). I wish now, as Mayor, to read you a formal address on behalf of the City of Ottawa, as follows:

ADDRESS OF MAYOR MORRIS.

Ottawa, 19th June, 1901

Mr. President and Gentlemen of the Canadian Electrical Association:

It gives me great pleasure to welcome you to the City of Ottawa. This is the second time you have honored our city with your presence, and I trust that your deliberations will be as profitable to yourselves and to your profession, now, as they were on that former occasion

I hope that you will not find the citizens of Ottawa deficient in extending courtesies which although they may not advance the science of electricity very materially, still will go a long way towards making your stay here pleasant and entertaining.

We are given to flattering ourselves here, that as an exponent of what is modern in electrical development, Ottawa leads the van. It is our proud boast (as statistics will maintain) that we have more incandescent lights per capita of population than any other city in the world. The fine street car service that you see here is the outcome of what was the earliest and most daring enterprise in street railway traction in Canada. The fine water power that we have at our front door here, enables us to do, and have, many things that will no doubt prove interesting to you on inspection.

The progress that can be noted here in electrical development is just a criterion of what is going on, on all sides. Everyone knows how essential to our comfort and convenience electrical devices have become. A few years ago, a light of the brilliancy of an ordinary incandescent lamp would be considered much too bright, in fact, injurious; now it has become so much of a necessity that people sometimes find fault with it.

The benefits of a Convention of this character cannot be too highly rated. Most of the startling developments of our time have resulted from conventions of this character. In your daily observations in your power houses and your offices, you see wherein some of your apparatus, or your methods, can be improved upon, or in some way made more efficient. You wish to let some of your fellow-workers know of your improvement. What better way can there be than by conventions of this kind? We all know the results. From the small local station, whose radius of distribution was limited to a mile or so, now we have stations supplying power forty and fifty miles from the source of supply.

There does not seem to be any limit to the development of your science. At the present time wonderful strides are being made in electrical transmission of power over distances, which is destined to do a great deal in developing this country as to manufacturing, and add to the comfort of living. The water power may now be brought to the doors of the factory, and through the much-abused, but highly prized trolley car, the poorest and humblest may take his family to live in the health and happiness offered by country surroundings—where each may, in time, own his little home.

Wireless telegraphy is destined to accomplish wonderful things in war and commerce. The applications of electrical science have become so many and have reached such a state of development, that their treatment calls for a very high order of knowledge. The profession of electrical engineering is certainly one worthy of the best minds, and to the electrical engineers of Canada is entrusted as much as to anyone the mission of developing the resources of our country, of raising Canadians to a higher degree of civilization, and making us all happier and better men.

Let me again repeat my welcome. I hope that your stay in Ottawa, will be such that you will always hereafter hold kindly feelings for us, and if anyone suggests again that a Convention of your Association be held here, you will not be averse to coming back. If such occurs, I can promise that your welcome will be as cordial as the one extended to you to-day.

W. D. MORRIS,
Mayor.

The President: I have much pleasure in introducing to you Alderman Deering, Chairman of the Civic Reception Committee, and I would ask him to address a few words

Alderman Deering: Mr. President and Gentlemen, members of the Canadian Electrical Association: I asked my friend, Mr. Dion, the other evening when we were discussing the Convention to leave my name off. I am sure after the eloquent address you have listened to by His Worship anything I can add will fall very flat. I must say it gives me a great deal of pleasure to be here to-day to extend to you a welcome from the citizens of Ottawa. We think that we can give a right royal welcome to anyone, and I hope that you will go away feeling that you have been well entertained. We will do the best we can. I hope, if the weather keeps fine until half-past four, to take my part and we will then give you a drive around the city, showing you our best residential streets, and also have a look at the new bridge and several other things, so that I think you will find that your afternoon has been well spent. Thanking you for calling on me, Mr. President, I will take my seat.

The President: I have pleasure in introducing to you Alderman DesJardines, and I would ask him to say a few words to you.

Alderman DesJardines: Mr. President and Gentlemen: The Mayor and Chairman of the Reception Committee have covered the ground pretty well, and there is not much left for me to say. However, I hope I may be of some use to you to give you a good time in our city while you are here, and I will do all I can to entertain you in the best manner possible, and I hope that you will come back to us before long, because we generally love to see good people come to our city; we cannot have too many good friends. I thank you.

The President: Your Worship and Gentlemen of the City Council, on behalf of the Canadian Electrical Association, it gives me very much pleasure to tender to you the thanks of the Association for your kindness in coming here this afternoon to offer us a civic welcome to this city. I am sure that all the members of the Association appreciate very highly your kindness in this matter. We thank you very heartily, and we trust that you will find it pleasurable to attend the meetings of this Association to which you are quite welcome at all times until our adjournment. I thank you very much.

The President: The next order of business, which should have been taken up this morning but was postponed on account of the Secretary not having his minutes here, is the reading of the minutes of the last annual meeting. I will call upon the Secretary to read them.

The Secretary read the minutes of the last annual meeting, which were approved and signed by the President.

The President: The next item on the programme is the reading of the Secretary's report.

The Secretary presented his report as follows:

SECRETARY-TREASURER'S REPORT.

I am pleased to be able to report a steady growth in membership and a widening interest in the Association by the members and persons and corporations interested in electrical matters outside. The valuable work performed by the Legislation Committee has exerted an influence

in this direction, yet many of the companies who benefited largely by this work are yet without the Association. If possible, means should be devised of adding more rapidly to our membership. If the privilege of membership were offered to electrical students in our Scientific Schools at the nominal fee of one dollar per year, as is done by the Mining Institute, it might be the means of inducing yearly additions to the membership of bright young men who in time would pay the regular fees and do valuable service towards advancing the objects of the Association. In this connection it has occurred to me that the Association might also think it advisable to offer yearly a prize to the Third Year Students in the Electrical Department of these schools, thereby manifesting its interest in scientific education, and at the same time keeping the Association and its work constantly before the attention of the young men who will take a prominent part in the development and management of electrical enterprises in the future. These suggestions are offered for what they are worth, to be acted upon or otherwise as the Association in its wisdom may decide.

Since last Convention the Executive Committee has held two meetings, first in Toronto, on October 9, 1900, jointly with the Legislation Committee pursuant to the resolution moved by Mr. Yule and adopted by the Association at the Kingston Convention, and secondly, on February 12, 1901, at the Windsor Hotel, Montreal.

At the first of these meetings action was taken with the object of securing the assistance and co-operation of the electric lighting companies in behalf of the work on which the Committee is engaged for the protection of electrical interests. Further details are omitted as they will probably be given in the Committee's report to this Convention. The President and Secretary were instructed to memorialize the Dominion Government regarding the desirability of establishing under a properly qualified officer a Testing Department, which would be at the service of electric lighting companies on payment of reasonable inspection fees.

At the meeting in Montreal on February 12th, last, the account for printing in connection with the last Convention was approved for payment, three new members were elected, and six resignations accepted, subject to payment of fees to the end of current Association year. Action with regard to resignations of persons connected with the Canadian General Electric Company was deferred until next meeting. Dates for the present Convention were fixed and an appropriation of $150 voted for the use of the Local Committee.

The following Committees were appointed to complete arrangements for this Convention: Committee on Papers and Topics for Discussion: Messrs. Gossler, Slade and Camp. Local Committee: Members of the Association residing in Ottawa, together with Messrs. W. H. Browne, W. J. Camp and A. B. Smith, with power to add to their number.

The advisability of inviting manufacturers of electrical apparatus to exhibit at the Convention was left to the discretion of the President. Mr. Angus was engaged to report the proceedings. The President, Messrs. Wright, Yule and Smith were appointed a Committee to recommend necessary amendments to the Constitution.

The number of members at present on the roll is as follows: Active, 235; Associate, 32; total, 267; a gain of 22 since last report.

During the year death removed a useful and much esteemed member of the Association—the late Mr. Charles P. Dwight, who died in Toronto on January 20th, last, at the early age of twenty-nine years.

Following is a statement of the receipts and disbursements:

FINANCIAL REPORT FROM JUNE 1ST, 1900, TO 31ST MAY, 1901.

RECEIPTS.

Cash in bank June 1, 1900	$339 83	
Cash on hand June 1, 1900	11 20	
121 Active members' fees, at $3	363 00	
16 Associate members' fees, at $2	32 00	
C. H. Mortimer—To replace Convention buttons lost at Hamilton Convention	6 25	
Legislation Committee—C.E.A.		
Envelopes used	1 00	
Loan of cuts	6 07	
		$750 35

DISBURSEMENTS.

Convention Expenses—		
Convention buttons	$12 50	
Grant to Local Committee	95 00	
George Angus—Stenographer	35 00	
C. Clement—Assistant to Secretary	3 00	
"Electrical News" printing account	94 90	
Cuts to illustrate Convention papers	23 16	
Ribbon for badges (1900)	1 11	
Express charges	1 60	
	$266 27	
Unpaid accounts—1899-1900	17 85	
Grant to Secretary	125 00	
Secretary's travelling expenses to Montreal to attend Executive meeting	20 00	
Postage	26 00	
Exchange on cheques	3 10	
Telegrams	2 23	
Stationery	8 00	
Express charges	75	
Ribbon for badges (1901)	2 81	
Membership cards (1901)	4 00	
		$476 01
		$282 74
Money in bank June 1, 1901	$276 47	
Money on hand June 1, 1901	14 27	
		$290 74
Unpaid accounts		8 00
		$282 74

RECEIPTS.

Money in bank June 1, 1901	$276 47	
Money on hand June 1, 1901	14 27	
44 Active members' fees, at $3	132 00	
10 Associate members' fees, at $2	20 00	
		$442 74

DISBURSEMENTS.

Printing badges for Convention	$11 75	
Postage on programmes, etc	20 00	
Exchange on cheques	2 70	
Express charges	29	
Telegram	30	
Stationery	45	
Money on hand June 17, 1901	13 53	
Money in bank June 17, 1901	393 72	
		$442 74

Mr. Purcell moved, seconded by Mr. Martin, that the report of the Secretary-Treasurer as read be adopted

Mr. O. Higman: I have very often been impressed with the fact that we throw away nearly the whole of our membership subscriptions in the annual banquet. Surely an

Association of this kind which claims to be scientific somewhat in its aims must have outgrown the barbarous custom of wasting time and means in mere physical gratification. After the banquet is over to-morrow, I shall take the opportunity of moving in this Convention that the annual banquet be dispensed with, and the funds be devoted to some more profitable purpose.

The President put the motion to adopt the Secretary's report. Carried.

The President read a telegram from Mr. McLea Wallbank, regretting his inability to attend the annual convention and wishing it all success.

The President: In accordance with the constitution and usual custom, in connection with the report of the Secretary-Treasurer, I will appoint Mr. Purcell, of Walkerville, and Mr. Sangster, of Sherbrooke, as auditors to audit the accounts of the Secretary-Treasurer and report to-morrow.

The President: The next order is the reading and discussion of papers, and I will call on Mr. O. Higman, of Ottawa, to read his paper entitled "Dominion Electrical Standards."

Mr. Higman read the paper, which was received with applause.

(See page 132).

The President: You have heard Mr. Higman's very interesting paper on the standards which have been provided by the Dominion Government. I think it is a matter for congratulation that we have some official standards established in this country. This is a matter that perhaps you have not appreciated as much as the companies doing business in Ottawa, who have been in a position to refer to those standards whenever they had any doubt as to the accuracy of their own instruments; and in order to extend these benefits to the whole of the C.E.A. as far as possible, during the past year the Executive Committee passed a resolution and communicated it to the Department of Inland Revenue, asking them to continue their work in this direction and to establish a standardization bureau where electrical companies could get their instruments standardized. It may be a little early to ask for this, but I think if the Association continues to exert its influence in that direction the time will come within a very few years, when a proper standardization bureau will be established at Ottawa, which will be of very great benefit to electrical engineers and others connected with the electrical industries in this country. The paper is before you for discussion. I think this is a very proper occasion upon which to take up the question, if you so desire, of the desirability of a standardization bureau, and it would be well to hear from the members present upon that point. If there was a general desire in that direction some resolution might be passed and transmitted to the Government. In connection with this I might say the Minister of Inland Revenue has extended an invitation to members of this Association to go to the Department and examine the standards which they have provided there. May I hear from Mr. Leonard on this subject, to start the discussion?

Mr. F. H. Leonard, Jr.: The question of a resolution as suggested by the President I think is a very good one. There is no doubt but what the Association needs some headquarters in which they can repair their instruments, and aside from the difficulty of getting a delicate instrument to and from Ottawa for calibration and returning it to the station, it ought to be a great help in the determination of accurate measurements. I feel that the Association ought to at least pass a resolution encouraging the extension of this Department of the Government so as to make it available to all the lighting and power companies in the country, and I will suggest now that a resolution be forwarded to the Department asking that the work be furthered to such an extent as to enable the lighting and power companies of the country to have this department available, and that a certain moderate fee be fixed, which will enable the companies to compare their instruments without being obliged to send them out of the country. Any person that has had occasion to ship out instruments for repairs will realize how difficult it is to get those instruments out of the country, standardized, back again, and then perhaps as soon as they are returned you find that they are inaccurate, or off zero, due to the jostling they get from the express company's hands. If the Secretary will put that motion in order it can be read and I presume there will be a ready seconder.

Mr. O. Higman: It was not intended originally to be a standardizing bureau; the work was introduced as a part of the weights and measures system of the country for testing the apparatus which measures the supply to the consumer. In order to do that we had to get standards, and so we were compelled to get in some standards at once for the purpose of comparison; but I may say we have always encouraged electric lighting companies to send in their instruments to be compared, and a certificate has been given showing the result of the comparison. No charge has been made to companies paying the annual registration fee. I consider myself that the companies paying this fee are entitled to consideration of that kind. Now whether we should proceed, as the President has pointed out, in establishing a regular standardizing bureau is a question that will largely be with the electrical industries of the country. The Government will not move, I imagine, any faster than they are obliged to. It is like drawing teeth to get money for scientific instruments. They do not quite see the utility of them; they think the money would do more good for missionary purposes, and so we have to get along as best we may with the little doles we get from time to time.

Mr. J. J. Wright: I was just about to ask whether this Standardizing Bureau would be simply for the purpose of comparing instruments that would be sent and a report made thereon, or would it be the intention of the Association to ask the Government to establish a bureau wherein these instruments could be put right—calibrated, in other words?

Mr. Higman: That would involve a good deal.

Mr. Wright: If that were done it would manifestly be a great convenience. It is not much satisfaction sending up an instrument and being told it is 4.7896 out. If there was some bureau established by authority where not only standard instruments but switch board instruments could be forwarded and corrected, I think it would be a good thing.

Mr. Higman: I think that should be the direction of the resolution. I have asked the Minister for a trained mechanic, for one thing, out of one of the instrument making establishments, and also for an assistant in the work, and the answer that I got from him was that "he would see." That may mean that we will get it or it may mean we will not get it. But he said at the next session of parliament it was likely he would make it an

independent branch of the public service with some additional help.

The President: There are several things it would be useful to know in dealing with this question. In the first place, the American Institute of Electrical Engineers has moved in the same direction in regard to the United States as it is suggested we should move here in regard to Canada. They asked the American Government to provide a Standardization Bureau. Perhaps somebody here will be able to tell us just what that means; whether it is intended to have a bureau for the mere comparison of instruments or whether it is intended this bureau should undertake the correction of instruments? I presume the standardization bureau that was asked for in the United States was to be on the same lines as similar institutions in other countries and if it is customary in such bureaus in European countries, where they have been established, to correct instruments as well as compare them, then I presume the Institute's request included the same feature and that we should embody the same thing in our resolution. Another thing we should know is what means we have got in Canada for comparing instruments. Some of the members here who live in Montreal may enlighten us in that regard. What facilities are there at McGill University for that kind of work? Will they make a comparison? I don't suppose they make any corrections, but will they make comparisons? I think these things would help us in arriving at a conclusion as to what action we should take.

Mr. G. R. Duncan: In McGill University they have a very complete set of calibrating instruments. The general custom is to take an instrument and compare it and draw out a curve showing at a glance what the correct reading should be for any indicated reading on the instrument. The average instrument, such as the voltmeter, may not be so much out near zero as it may be farther on the scale. The error of the reading may possibly be due to irregularity in the magnetic field. Such a thing as that would be difficult to repair. In fact, I don't know of any method for repairing that. The only thing to do is to calibrate the instrument, showing, by means of a curve, what should be the reading for any indicated reading of the instrument. I think McGill University will calibrate any instrument and give it a curve such as I have described. As for repairing instruments, I believe they do, on special occasions, repair an instrument, but I don't think they make a business of it regularly. They have there instruments for measuring with an accuracy of something like one part in ten thousand for measuring current or resistance or E.M.F.; and I think one of our men has got comparisons of one part in 100,000. As far as comparing and calibrating instruments is concerned, I don't think there is anything to excel the equipment of McGill University.

Mr. Higman: With reference to the United States, at the last Session of Congress they passed a bill voting $250,000 for the building itself, and providing for a staff, the salaries aggregating $27,000 a year, comprising a director of the bureau and three physicists, three chemists and some mechanical assistants. I presume the intention is to calibrate and repair instruments sent to them.

The President: Mr. Leonard, what form do you wish to give your resolution? Do you want to include the repairing features?

Mr. Leonard: I think it would be well to do that, to make it cover the calibration as well as comparison. If we could get a standardization which bears the stamp of the Government it would be well to get a chart or something which would enable us to read our instruments correctly. I think we ought to go still further, to suggest the extension of the department to cover the repairing or adjustment of instruments.

The President: It is moved by Mr. Leonard that a petition be addressed from this Association to the Government, stating to them that it is the desire of this Association that a standardization bureau be established by the Government wherein instruments may be compared and calibrated and repaired, which are used for making electrical measurements.

Mr. Thornton: Is it absolutely necessary to have an instrument repaired? If you have got a calibration curve I think that is about all that you want.

The President: If you are asking for anything from the Government it is a good scheme to ask for more than you want.

Mr. Holman: You are asking a great deal of your Government to ask them to institute a department which will be an adjunct of your calibrating department in which department you will have repairs made. All makers of instruments like instruments for repairs sent in to them, and to ask your Government to go into the repairing business is something they won't do, it seems to me. Any physical department of any institution will naturally furnish a curve upon being asked, and that curve will be sufficient for the reading of your instruments and make them accurate. If the instrument is actually out of order and needs repairing the proper place to send it is to the maker.

The President: The point made by Mr. Leonard was the difficulty of getting the instrument to be repaired, across the border. You have got to get a lot of papers filled out and there is the shipment of the instrument. There is a great deal of delay. In every other sense it is undoubtedly better to send to the makers.

Mr. Martin: I second Mr. Leonard's motion.

Mr. J. J. Wright: Before that motion is carried and before the question terminates it should be thought over a little more carefully. Of course I asked a question as to whether this bureau would undertake to put an instrument right when it was wrong as well as to tell you how much it was wrong, but I did not quite endorse that view of it. There is a good deal of force in what the last speaker said. We must be careful in approaching the Government, in asking for anything, that we go about it in the right way and ask for exactly what we want. I think your theory on general principles is a pretty good one: ask for plenty and then perhaps you will get something you are looking for. But in this case it bears rather a different interpretation. I am inclined to think that the principal function the Government should be called upon to undertake would be purely the calibrating of the instrument; it would then become a standard for the company. The calibrating curve could be used with that instrument when it was used as a standard instrument only. The company which employs good mechanics can then repair and have repaired their station instruments, using the calibrated instrument as a standard. I think the question ought to be a little more thoroughly considered as to whether that would not be about the extent of the function which we could ask the Government to undertake.

Mr. Reesor: I think Mr. Leonard's difficulty could be got over in this way, to request the Government to ask the makers of these instruments to come over on this side of the line. (Laughter.)

Mr. Thornton: What is wanted, it seems to me, is not a very high degree of accuracy for all instruments used in the station. Most companies have a large number of instruments that are in daily use and also a set of standard instruments, which they use to standardize all the other instruments from. As these station standards are liable in time to get out of calibration, it would be a great advantage to be able to send them to Ottawa and have them re calibrated rather than to have to ship them out of the country.

The President: It has been suggested to me that it might be a good way to deal with this question to appoint a committee of this Association to carefully consider the whole question and then draw up a memorial to the Government in proper form, asking for such advantages as are deemed proper. Perhaps it could be done better in that way than by passing a resolution hastily without proper consideration. However, that is a mere suggestion, and the only resolution before the chair is that of Mr. Leonard. If there are any amendments I would like to hear them.

Mr. Leonard: I would be quite willing to withdraw my motion and leave this matter open for a committee. I think it would be put in better form probably if we had a little discussion on the matter and arranged upon a resolution which we could present to the meeting, which would cover exactly what we want, rather than to do this thing too hastily.

The President: It will be necessary for some one to move that a committee be appointed.

Mr. Martin moved, seconded by Mr. Kitchen, that the President appoint a committee to draw up a properly worded memorial to be presented to the Government, the personnel of the Committee to be left to the President of the Association to appoint. Carried.

The President: I will appoint on this Committee Mr. F. H. Leonard, Jr., of Montreal, Mr. P. G. Gossler, Montreal, Mr. J. W. Campbell, Toronto, and Prof. Owens, of McGill University.

Mr. O. Higman: There was one subject in connection with the Government work I would like to allude to and that is with regard to the Inspection Act. We secured an amendment last session whereby inspection by the Government is made absolute and the inspection of meters by what we call tramp inspectors is prohibited. Those people in fact went so far as to create a company called "The Standard Electric and Gas Meter Company"; they undertook to give certificates and make inspections and it was found necessary in order to protect not only the supply companies but the consumers themselves, to pass an amendment whereby any inspection apart from the Government inspection was made illegal, with a penalty of $25 for each inspection.

At 4.15 o'clock p.m. the Convention adjourned to Thursday, at 10 o'clock a.m.

SECOND DAY.

The President in the Chair, called the Convention to order at 10.15 o'clock.

A telegram was read from Mr. Edward Slade, of Quebec, stating that by reason of unexpected and important business he would be prevented from attending the Convention. An invitation was also read from Mr. Evans of the Montmorency Light, Heat and Power Co., to hold the next Convention in the City of Quebec.

The President stated that Mr. Doherty had sent word to Mr. Gossler, Chairman of the Committee on Papers, that he had been taken ill and would not be able to travel, and he much regretted he would not be able to attend the Convention and read his paper.

Mr. J. M. Robertson, of Montreal, read his paper on "The Influence of the Load Factor on the Design and Operation of a Lighting and Power System," which was well received. (See page 136).

The President: Gentlemen, the paper just read by Mr. Robertson is certainly one of the most exhaustive and practical we have had before us. It is now before you for discussion and I trust the discussion will be such as to bring out all the very important points it covers in order that it may be useful to us in a greater degree.

Mr. J. J. Wright: I do not feel myself competent to discuss a paper of this nature, but for the sake of starting somebody else going I just call your attention to one part of it that strikes me as being worthy of notice, and that is the meters spoken of by Mr. Robertson with a varying speed, which would be very desirable to measure power, but under the circumstances I think it would be impracticable here with the Dominion laws governing the inspection of meters. Perhaps Mr. Higman can enlighten us on that.

The President: I would like to know from Mr. Robertson whether these meters, which I understand are self-winding, clock-working, are reliable and can be depended upon to change at the proper time so that the total reading would be correct.

Mr. Robertson: That is exactly the trouble with the meters that are on the market now; they are not, so far as I know, entirely satisfactory in that way. A great many of the self-winding mechanisms are actuated by batteries and these give trouble at times. In America there are not a sufficient number either made or installed to tell a great deal about them. With reference to Mr. Wright's objection that they would not comply with the Inland Revenue regulations, I personally would not want a meter that would run fast or slow, I would want a meter that would run on two dials; and it would simply be a question of making a different rate for the indication of one dial to that on the other; the entire registration of the day would be the sum total of the two dials. That would comply in every way with the Government regulations, as the meter itself could be entirely sealed the same as an ordinary meter and the governing medium would be outside of the meter. There has been something designed by which they control the overlapping of the dials on the circuit, but as most of the lighting in Canada is alternating it is not applicable. I think it still remains for some very enterprising companies to get out a meter that is really good.

The President read the report of the Committee on the nomination of the Standing Committee as follows:

Committee on Statistics: Messrs. A. A. Wright (chairman), K. B. Thornton, and J. F. H. Wyse.

Committee to Confer with Underwriters: Messrs. P G. Gossler (chairman), Edward Slade, A. A. Dion, Alderman Sadler, A. Sangster and J. J. Wright.

Committee on Arc Light Rating: Messrs. O. Higman

(chairman), P. G. Gossler, Fred Thomson, John Yule, Prof. Owens, J. R. Robertson, and A. B. Lambe, Jr.

Committee on Legislation: Messrs. John Yule (chairman), B. F. Reesor, A. A. Wright, C. B. Hunt, W. H. Browne, A. A. Dion, W. H. Briethaupt, R. O. McCullough, J. J. Wright, with power to add to their numbers

Committee on Standardization of Accounts: Messrs. D. R. Street (chairman), H. H. Henshaw, A. A. Wright.

Mr. J. J. Wright moved, seconded by Mr. A. B. Smith that the report be adopted.

Mr. Yule: Before that is adopted, I suggest that Mr B. F. Reesor be put on as chairman of the Legislation Committee. He has been on for a great number of years and his services have proved very efficient and valuable in that position.

Mr. Reesor: I think Mr. J. J. Wright makes a very good chairman; and he is all right and in the right place.

The President: Mr. John Yule is named as chairman here.

Mr. Reesor: He is a better man, perhaps. (Laughter.)

The President: We have all come to regard Mr. Yule as being so fond of this work that we do not like to take it from him.

The motion to adopt the report was put and carried.

Mr. L. Denis, of Quebec City, read his paper on "Balancing a 3-wire Alternating Secondary System," which was greeted with applause. (See page 134).

The President: This is another valuable paper which I hope you will not let pass without some comment. It would be really too bad that the paper read by Mr. Robertson and also this one should not provoke some discussion. They surely give room for discussion.

Mr. Fisk: Mr. Denis mentions in his paper properly fused junction boxes in the two outside secondary wires I would like to have a description of that box and the kind of fuse.

Mr. Denis: The box used is an ordinary cut-out motor fuse box—an ordinary street car motor fuse box; and practice shows that the fuse to be used should not be above a third of the capacity of the transformers that are banked. Sometimes we have to exceed that though, that is, when we cannot get the proper line arrangements.

Mr. Leonard: Did I understand that the fuse was to be one-third or one and one-third?

Mr. Denis: One-third. It is only supposed to be used when one transformer is loaded more than another. I may add that we have to inspect these junction boxes every week. We are very particular about that. And of course we replace any fuse that is blown; also whenever we have any blown fuse, a special study of the district and the condition of the load has to be made, because the fuse should not blow.

Mr. Thornton: We have one or two secondary three-wire systems in Montreal, and that matter of blown fuses is quite a thing. We do not make a point of making a special inspection. Our attention has generally been drawn to the fact that there is a fuse blown somewhere by a telephone message from a customer that the lamps are rather dim. We only have one or two of those systems and we have not made a specialty of special inspection. There are one or two points in Mr Denis' paper I would like to refer to With regard to the slips that are given out to the foremen, I did not quite understand how they designated which side of the three wire system they wanted the customer to be connected from. I always, in Montreal, designate them by saying I want them connected from the sidewalk sihe or the street side. We have maps showing the sections, the size and everything else of the wire, and you can very easily lay out for yourself what side you want the customer to go on; and you simply tell the line foreman that you want the customer of such and such an address to be connected from the street side or the sidewalk side. We also find, to be absolutely certain of our records, we have very often to make a second inspection of the line to make sure the lineman properly reports the work he has to do. He turns in his slips in the same way as Mr. Denis reports on, but we find they are often inaccurate.

Mr. B. F. Reesor: I would like to ask a question. What kind of fuse does Mr. Denis use—an alloy or just common fuse?

Mr. Denis: Just common fuse.

Mr. Reesor: When you said one-third of the capacity did you mean of the bank or the transformer?

Mr. Denis: Of each transformer. The transformers that are banked are all of the same capacity. The fuses in the junction boxes all along the bank are a third of the capacity of each transformer.

Mr. Reesor: The way we do in our case, in designating the different lines, is this, instead of using cross-arms we have the wires on an iron bracket under the cross-arm and they go in a triangle and we designate them by the top or bottom wire.

Mr. Robertson: I understand from this with regard to the connection of the transformer to its own mains, that the mains run each way from the transformer?

Mr. Denis: Yes.

Mr. Robertson: When you have to reinforce a transformer how do you know on which side of that overloaded transformer to connect the other one?

Mr Denis: In that case a special study of the district has to be made. The bank is not only subdivided into transformers, but the transformer has to be subdivided on each side and trial records made of that.

Mr. Robertson: That is what I wanted to know. You said you did it on your records and I wondered how you did it in the office.

Mr. Denis: Oh no. The only information regarding it which the records give is that a certain portion of the bank, say one transformer is being overloaded. If you want to go into further details you have to subdivide that portion of the bank.

Mr. Robertson: Also, when you say what its approximate maximum demand will be how do you know it is going to arrive at the same ratio?

Mr. Denis: It didn't at first, but the figures show they all bear the same ratio.

Mr. Reesor: What means have you of ascertaining when a fuse in one transformer goes? Just by the lights themselves?

Mr. Denis: In a transformer or junction box?

Mr Reesor: In the transformer.

Mr Denis: Then the junction box fuses would be blown.

Mr. Reesor: If it is not overloaded?

Mr. Denis: In most cases it is. If it is not and if we found by our records we could dispense with that transformer, we would, immediately

Mr. Reesor: Your minimum load might be on and it would not be noticed until the maximum load came on and then the whole thing would go.

Mr. Holman : I have used the Wright maximum demand meter on a transformer to ascertain its maximum load ; I have also used it for the purpose of ascertaining the load of a customer when I was suspicious that that customer was using more than a normal amount. We put the meter out on a pole.

Mr. Denis : We corresponded with the Wright Maximum Demand Meter Company and never got any answer. We asked them if their meter would stand to be put out on a pole and we never got any answer from them.

Mr. Purcell : I have used the same instrument for that purpose and put it on any voltage and it is one of the finest instruments you can get hold of ; and it is surprising how the results will differ from what you think they are.

Mr. Denis : It doesn't seem so from these figures. We find now we can almost dispense with them, although we didn't at first.

Mr. Holman : It was only on a suspected circuit that the instrument was used ; we did not have one meter for each of our transformers. We simply used them for confirming or exploiting our ideas in connection with that transformer ; and as the gentleman immediately after me stated, I have found the facts as represented by that meter a little at variance with my ideas of what the transformer was.

Mr. J. J. Wright : I think we should not let the occasion pass without moving a vote of thanks to both Mr. Robertson and Mr. Denis for the two able papers we have just heard read.

Mr. Martin : I take pleasure in seconding the motion.

The President put the motion, which was carried with applause.

Mr. Holman : Before adjourning for the morning I have one question to ask Mr. Robertson. His paper is worthy I think of a great deal of thought and there is one very small question that occurred to me. I would like to know his experience with the use of a meter for measuring small capacity motors, where the load on that motor was of a thoroughly variable nature, whether the customer complained of his bills or not ?

Mr. Robertson : I am afraid Mr. Holman has asked a good deal larger question than he thinks. We have a very large number of small customers, varying from one half H.P. up to anything you like and we do have a considerable number of complaints from our smallest customers with reference to bills, but as a rule it is because some outside person speaks to the customer and tells him something about his meter, and he then proceeds to read his own meter and figure out his bill. We find as a rule when we take the question up with him we have no trouble at all. We are using a Stanley meter for small customers and have no trouble whatever in proving to the customer that the meter is correct ; should he so desire we offer him the option of having it tested himself and he may call in any outside person he likes, we having the right to be present. I might say with reference to accuracy of integrating meters on variable load that they are as perfect as there is any necessity for. The inertia of the moving element is so little that with full load on a meter the time elapsing between opening the switch and looking at the meter is sufficient for it to stop. Some time ago there were some elaborate tests made on Thompson wattmeters to determine the error introduced by inertia and the instruments were found to be practically accurate. As the inertia of such a meter as the Stanley is much less, the accuracy would be correspondingly greater.

Mr. B. F. Reesor moved, seconded by Mr. John Yule, and resolved, that the sympathy of the members of this Association now in session at Ottawa be, and the same are hereby extended to our esteemed fellow member, Mr. A. A. Wright, M.P., and family, of Renfrew, in his bereavement by the death of his only daughter; and that a copy of this resolution be forwarded by the Secretary to Mr. Wright.

The President: You have all heard the resolution. It is especially regrettable because Mr. Wright has been a constant attendant at our Conventions. I do not remember one where he was not present and did not take an active part, and when I missed him here on the first day I supposed there must have been some very serious reason to keep him away.

The motion was put and carried.

GENERAL BUSINESS.

Mr. Thornton: In regard to the institution of a student membership clause in connection with the Canadian Electrical Association as suggested in the Secretary's report, the Canadian Society of Civil Engineers have a student's membership, and I think it would not be a bad idea to have the same introduced in connection with this Association, with a view to infusing new blood into the Association from time to time and also drawing members from the scientific and technical colleges throughout the country, and I think we may get some good men out of them. I think it would be very useful to the Association.

The President: I think the Secretary has given this question some attention, and if I am not mistaken he has consulted with some of the authorities of some of the colleges in that connection and I would like to hear from him.

Mr. C. H. Mortimer: I may say Mr. President and Gentlemen, that I have not consulted with the authorities of the schools with regard to this matter, but it has occurred to me, and I have thought for some time past that this Association might and ought to keep itself in touch with the young men who are passing through our scientific schools; and a short time ago I noticed that the Canadian Mining Institute had established a special fee for students of one dollar per year, and it occurred to me it might be a good idea for this Association to have a special fee for students that are passing through, taking the electrical course in our scientific schools; and these students would, after passing through the schools, probably become and remain members of this Association, and would become valuable members.

Mr. Reesor: They would be associate members in the ordinary way?

Mr. Mortimer: Yes. I would suppose that they would become associate members. I don't suppose they would desire the right to vote. And I thought also that perhaps the Association might offer a yearly prize to the third year students in the electrical department of our scientific schools, which would also keep the Association before the students in the schools. I would be very glad if the membership would express their opinions upon the suggestions.

Mr. Purcell: I think it possibly would resolve itself into a matter of funds. I thing if necessary to give a prize it might be desirable to advance the fee for active

membership, say from $3 to $5. I for one do not feel at all backward in coming up to the additional amount, and I feel heartily in accord with the movement suggested by our Secretary.

Mr. E. B. Biggar: I may say that in attending the annual meetings of the Canadian Society of Civil Engineers I have noticed that the student members of that Association avail themselves very fully of the privilege of attending the meetings, and at many of these meetings the attendance of the students at McGill is larger than that of the regular members. They have three or four classes of membership, a full membership, an associate membership and student membership, the student membership being for the students of colleges and universities. I think Mr. Mortimer's idea is a very excellent one; I feel sure that the Association will find a very great benefit in the immediate future.

Mr. Mortimer: I might say this prize, in my opinion, need not be a very large prize, and it might be given for a paper or thesis which could be read at the annual conventions.

Mr. McBurney: In the way of a suggestion, I would say that the same thing seems to strike nearly every member I have spoken to, that if a fee of $2 were charged for the annual dinner, not touching the funds of the Association, it would be satisfactory to every one. I would not like to say anything about the management of the Association, any more than to make a suggestion, and that would be this, that if a clause similar to what Mr. Mortimer has spoken of were introduced into the organization I think it would exclude or have a tendency to exclude some of the plant managers; I think the tendency would be for some of them to stay at home and let the students, who are not so much interested in the Association, attend the Conventions.

Mr. J. J. Wright: I think if there is any such suggestion adopted it would be a very favorable opportunity to revert to the original intention of Constitution and to draw the line more sharply between active and associate members, which has gradually become obliterated. The fee is different, but the standing appears to be about the same. If three grades, as in the Canadian Society of Civil Engineers, were adopted it would be in harmony with the constitution and there would be the active members, with all the name implies, the associate members and student members. I do not exactly agree with the idea of the last speaker that the admission of students would necessitate or cause the control of the Association to pass entirely, or in any other manner, into their hands, because the powers of the various grades in the Association would be necessarily defined and limited.

The President: This is an informal discussion, there is no resolution before the chair, therefore I may be privileged to speak upon it. My own views are that we ought to have three classes of membership in this association, three well defined classes, active, associate and student members; and that the fees ought to be $5 for active members, $3 for associate members and one dollar for students. That is the way I would like to grade it. Now, as to the question of having a prize for an essay or paper to be read at the annual convention, I think it is a very good idea, but I think the Executive Committee already have sufficient powers to enable them to carry that out if they deem it desirable, after the student class membership has been instituted. They could offer such a prize and get papers to be read at the annual meeting, and this prize need cost very little, because it is not the intrinsic value of a prize of that kind which gives it worth; a medal at a comparatively small expense would be entirely acceptable for a thing of this kind. I don't know just how these changes could be carried out; I think it would be necessary to amend the constitution, and I don't believe that according to the existing constitution we could do anything at this Convention. If I remember right it is necessary to go through a certain form of notice, and it is quite doubtful if we could carry it out so as to make any changes in the constitution at this present convention; but I think it is well to discuss the matter, and if we can get our views narrowed down to certain lines and embody them in the form of a resolution we could appoint a committee to develop the scheme and prepare amendments to the constitution. I may say that during the past year the Executive Committee has been engaged in revising the constitution to some extent; it seems to be defective in some respects, and this work was not completed, so that the whole thing could now be taken up together and at our next meeting a proper scheme could be proposed ready for adoption. If your desire is that student membership be established at once, and if the constitution affords a way to do it at this meeting, I would be glad to do all I could to assist.

Mr. A. B. Smith: I think on reading the constitution you will find the membership is confined to two classes, associate and active, and we cannot legally make any change unless we amend the constitution. We can at the present make no change, but we can give notice of motion.

Mr. Purcell: I think this matter can safely be left in the hands of the Executive Committee with power to act. They have the power, I think, according to the constitution, to make any amendments.

The President: Not to make amendments.

Mr. Purcell: If not, then some of us can give notice of motion and bring it up at the next meeting.

The President: The constitution provides for two classes of members, and of course if we add another class we amend the constitution. I will read you the clause regarding notice of amendments to the constitution. (Reads Article X of the constitution). If I interpret this rightly you should get permission this morning to introduce an amendment and give notice thereof. This could be considered at this afternoon's sitting, the chairman could then appoint a committee to whom it would be referred, and this committee could report to-morrow morning, and we could then dispose of the matter, when it would require a two-thirds vote of the members present to carry the amendment. I do not suppose, in giving notice of motion, it is necessary that the exact wording of the amendment be stated, because it may require some little time to get at the proper wording, but if notice of motion was given that Article 3 of the constitution be amended by creating a student membership class, I think that would be sufficient, and the matter could be dealt with in that way; but it would be necessary to have the permission of two-thirds of the members present to put on record a notice of motion at this morning's sitting.

Mr. A. B. Smith: I would suggest that the sense of this meeting be taken as to the admission of student members, and then if it be favorable that the revision of

the constitution which is necessary be undertaken by a committee to report later.

Mr. Purcell: I will ask permission to introduce a proposed amendment.

The President: The question is, shall we permit Mr. Purcell to give notice of motion that Article 3 of the constitution be amended by creating a class for student membership and fixing the fee?

A vote being taken on the proposition it was declared carried unanimously.

Mr. Leonard: I would like to ask a few pertinent questions on the matter of student membership. What is the Association to gain by this special membership, if we ask, as proposed, a fee of one dollar? The cost of a seat at the banquet will more than amount to that. The funds of the Association are not going to be benefitted. I believe that such a membership would be a benefit perhaps to the Association and also to the student members whom we might succeed in gathering in. It places a young man in contact with men of experience in a line of business which he proposes to follow in his future life, and enables him to pick up pointers whereby the college will help him in the future. So far as a thesis or paper that might be prepared by a college student is concerned, the Association I think would have comparatively little to gain in the practical operation of the business. It would probably be of a theoretical character and something which many of the practical men would not be able very well to follow. However, as I said I only wanted to ask a few pertinent questions and get the members thinking about this thing to see what it amounts to.

The President: I might say in reply to Mr. Leonard I did not state all my views regarding this question of fees. I stated I thought active members should pay $5; in the first place, that is an increase of $2 over the present fee. I am also of the opinion that the Association should not be expected to provide a free banquet for its members. There is no other Association possibly in the world that does it. I have never attended a banquet of the kind without having to buy a ticket, unless I was a specially invited guest. I am not in favor of dispensing with the banquet, but I am in favor of making it a pay banquet. There are members who do not care for banquets and we should not compel them to attend; but those who like banquets should assemble together and pay their fee just the same as they would anywhere else. This will properly come up in a resolution which I understand will be presented to-morrow, and perhaps as presiding officer I should not have stated my views on this subject. However, I say this to show that the introduction of the student membership would not involve any expenditure to the Association.

Mr. Moore: The Canadian Society of Civil Engineers has a very large student membership, and every year they transfer a very large percentage of the student members into associates and active membership. As regards a thesis, some students are very theoretical and some students are very practical. I feel quite sure there are a great many students who will be able to give a paper that would be of interest and also have a practical benefit. The student in the laboratory has at his service some of the very best equipments for testing apparatus that is used every day. I have seen transformers and other apparatus sent in to the university to be tested which could not be tested at any other place; and a paper has been presented describing the process of testing these apparatus which has been of very great practical benefit to those who bring them to be tested. Very often a student that is taking an engineering course can write a very good paper. I think in my opinion the President has very good views with regard to the dinner; I don't think a student would ask for a free dinner. In the Engineers' Society the student has no vote; attending the meetings and coming in contact with other engineers is where the student looks for his benefits.

Mr. Hamilton: The American Society of Mechanical Engineers has a student membership, and at nearly every Convention there are one or more papers presented, written either entirely by these student members or by a student member in collaboration with older men, and these papers are regularly published in the annals of the Society and form part of a very valuable collection, because as a rule they are papers on tests made by having at their disposal the finest equipment to be found anywhere, and these tests are worked up more fully because a man has more time; and they form a very valuable part of the literature of the Society.

The President read the report of the Auditors, stating that they had examined the books and vouchers of the Secretary-Treasurer and found everything correct.

At 12.10 o'clock the Convention adjourned to 2.15 o'clock p.m.

AFTERNOON SESSION.

The President called the convention to order.

The President: The first order of business for this afternoon is a notice of motion which was recorded this morning regarding the amendment of Article "3" of the Constitution. This is now open for discussion. If Mr. Purcell is here he could tell us what particular form he wishes the amendment to take.

Mr. Purcell: The object in bringing this motion before the Association is to make it possible for young men, students—not to make it necessarily a student membership, but to make it a membership whereby young men who are students in scientific branches or following up or possibly taking a course by correspondence might become members of this Association, because in the future they are to be our station men and possibly managers. I gave the notice of motion for the purpose of having the matter thoroughly threshed out before getting it into shape, and before wording it at all.

Mr. J. J. Wright: That would bring up the whole question of varying grades of membership, active, associate and student membership. If it is proposed to amend the constitution it would be well to take up these questions together and also the question of fees to be paid by each of these classes so that the whole thing could be incorporated in the constitution at the one time.

Mr. Hamilton: It seems to me a large part of the value to be derived from this junior membership would be the fact that these men were associated with technical schools whose facilities were such as to make the work of the students of some value to the Association. It does not seem to me it would be wise, therefore, for the Association to open the doors to any young man interested in electricity; I should think it would be rather better for the Association to say that membership on a certain number of years study in a technical school, the

number to be decided upon by the Executive Committee, shou.d be eligible to junior membership.

The President : Gentlemen, the question as I understand it is a pretty broad one. Article 3 of our Constitution defines two classes of membership, active and associate. The distinction is not very clear and I think the wording of that article could be improved upon so as to better draw a line between the two classes. As it now stands, the distinction is so slight that gradually the line has been obliterated, as was stated this morning, so that now it remains altogether with the applicant to state whether he desires to be an active or associate member, and the Executive Committee have no choice, practically, but to admit him to the class to which he asks to be admitted. There has been a desire expressed in some quarters that there should be two defined classes, active and associate members, and then it was suggested later that we should have a third class of student members whereby students in colleges, technical schools and universities might join the Association by paying a smaller fee than the ordinary members ; and that these members might be allowed to submit a paper at each annual convention. For instance, a competition might be got up that the student who produced the best paper in the estimation of the committee appointed to judge would be allowed to read his paper before the annual convention. That is the question before you now as I understand it, and as Mr. Purcell I believe wished to raise it. Although Mr. Purcell applied himself particularly to the creating of a new class of membership, I think it would be well since the question has been brought up, to get a very full expression of opinion from the meeting as to what is the desire regarding this membership question, so that when the constitution is taken up and this clause is re-written it should be done thoroughly, it would not be necessary to take it up again next year. In order that any amendment may be carried it is necessary that the matter be settled this afternoon, and according to the constitution a committee will be appointed to draft a clause and to-morrow morning the amendment to the constitution may be made, provided two-thirds of the members present are favorable to the change. What I ask you for is an expression of your opinion regarding membership generally, whether the present article is right or whether we should amend it and in what way. I think you should not restrict yourself to the student membership but discuss the whole question. I invite you to freely express your opinions so that we may know what the feeling is.

Mr. F. Nicholls : The present constitution covers all the ground that is necessary, and I think if trouble has arisen, if trouble it can be called, it is because this rule has been more honored in the breach than in the observance. I have always felt strongly that the executive officers of the Association should be composed wholly of members that are actively engaged in operating companies, and I have felt that it was a serious mistake, that it was a menace to the future well-being of the Association, to have the offices open to those representing manufacturers and supply and other commercial companies whose commercial interests are to sell supplies to the active members of the Association. I have been consistent in this. I was present, Mr. Wright will remember, and Mr. A. B. Smith and others, at the very first meeting, when it was proposed to organize the C.E.A., when that question came up, and at that meeting I was honored by being asked to allow my name to go in nomination for the vice-presidency ; I declined then because I felt then, and I stated then, that my conviction was that being interested in a manufacturing company I was not eligible, and that I would not, at all events, be the one to set what I considered such a bad example. We had that experience years ago with the National Electric Light Association, of which I was then and am now a member ; we had quite a discussion and it finally resolved itself into drawing the line hard and fast between the associate and active members. We do not have enough interest shown in this Association by the active members; we do not have a sufficient proportion of the central station managers attend our convention. In looking over the list from year to year it strikes me that the proportion is about two-thirds to one ; in other words, two-thirds what we may call the commercial end and one-third the operating end. I think it would not be a very difficult matter to change that proportion. Not that you would have less of the commercial end, because their business interests, if nothing else, will cause them to be present at these meetings which bring so many of their friends and customers together, but I think while there would be no less number of commercial representatives present, that there would be a very large increase in the central station representatives if it were felt that the Association were going to take up matters and work more diligently in the interests of matters that so directly affect to-day the operation of central stations, and more particularly the value of their capital invested. I don't know how it is in Quebec, but in Ontario everybody that has a dollar invested in an enterprise that is largely dependent upon a municipal franchise sits in fear and trembling from the moment the Ontario Legislature meets until we heave a sigh of relief after prorogation. We don't know unless we have someone watching every bill that comes up—there is some little thing, one clause of an unimportant bill that will come up that will be fraught with all kinds of danger to those who have capital invested in electrical enterprises, and this Association through its Legislation Committee has certainly done some grand work during the last two or three years, but I think in the time of peace we have to prepare for war, and we are going to have more trouble in the future than we have had in the past. I am not going to say very much more about it, although I reserve the right to speak again on this question if, in answer to any arguments I may hear, I wish to submit the broad question for discussion whether it is not better in the interests of the Association to draw the line sharply between the active and associate members, as was at first intended when the constitution of this Association was drafted and accepted by the Association.

The President : Until someone desires to speak upon this I might explain the possible reason why the Executive Committees of the past few years have honored this rule by the breach rather than the observance, as Mr. Nicholls says. From the peculiar wording of this clause: "The term active members includes all members actively engaged in electrical business. The term associate includes those interested or actively engaged in any electrical pursuit." I can't see any difference. I gave it up long ago. That is exactly why the line was obliterated. There never was any line in so far as the wording of the constitution is concerned. And if there is to be any line this article must be amended.

Mr. Nicholls : So as to have the matter open for discussion I move that an amendment be made to the constitution which, in effect, will mean that the active membership be confined to those who are altogether engaged in the operation of central stations, whether they may be electric light, power, telegraph or telephone men : that the associate members be those who are engaged in the selling end of the business. That can be worded suitably. That is the sense of the resolution.

Mr. Purcell : My motion is to amend the constitution as seen fit by your committee of five which will be appointed.

Prof. Owens : I second the resolution.

The President : The motion is that the constitution be amended in such a manner as to create a class of student members. I think we might take both Mr. Purcell's and Mr. Nicholl's motions together.

Mr. Nicholls : I am willing to add Mr. Purcell's motion to mine or to allow mine to be added to his.

The President : Mr. Nicholls moves that the article be amended so as to define clearly between active members who shall be those engaged in the operation of central

plants, and associate members, who shall be those engaged in the selling of supplies. I think these motions should remain on the table until we have had some more expression of opinion.

Mr. J. J. Wright : That would exclude from active membership those who are scientifically engaged in electrical matters outside of the actual operation of central stations. We have a number of men now who are professors in various colleges and universities, and if the wording of the clause was made to cover only those actively engaged in the operation of central stations it would have the effect of excluding the others.

Mr. Nicholls : That is not the intention.

The President : What is meant is that there should be a class of people who sell goods and another class of people who do not sell goods.

Mr. Leonard : Just to make it clear, I am not connected with either of these departments, I am in the engineering business, and it seems to me I would be classed out altogether. I would like to enquire which category I should come under ; and Prof. Owens, in the same way, would not be included in the motions as originally framed.

The President : Do you sell goods ?

Mr. Leonard : No.

The President : Then you are in the other class.

Mr. Leonard : Which other ?

The President : The class which does not sell goods. (Laughter).

Mr. Leonard : The members who do not sell goods are entitled to full active membership.

The President : Provided they are connected with the electrical business in some way. Unless there is any more discussion the matter will go to a committee. This is not to be voted on this afternoon, but the object of this discussion is simply to enlighten the committee who will draft a clause as to the particular way that the clause should read. The discussion and vote will come up to-morrow morning when the committee report after having drafted the amendment as desired by the proposer.

Mr. Smith : How about the question of fees ?

The President : The notice of motion only covers article 3, and does not cover article 5. The notice of motion should have been made to cover both articles. I think it would be in accordance with good practice to allow this notice of motion to be altered by unanimous consent of this meeting. There being no objection the notice of motion was altered to include article 5.

Mr. Leonard : Before this committee is appointed, and before we lose sight of this matter of classification of membership, I would like to raise another point, not for immediate decision but for the consideration of the committee appointed. My own case made the next instance occur to me. Take Mr. Kynock ; he is in the engineering department of the Canadian General Electric Company, he is not in the sales department, but he is an attachè of the Canadian General Electric Company, and I might mention a couple of other members here I see before me in similar positions. How would it be proposed to classify them ? It does not separate the two classes in exactly the way I take it Mr. Nicholls intended it should be divided. As I understand Mr. Nicholls' idea is to make this Association an association of electric light companies or companies in the electrical business, and follow somewhat after the pattern of the American Association known as the National Electric Light Association. It makes rather a complex matter, this division and subdivision and classification, it seems to me ; and I think there is a chance for a little further discussion before the committee attempts to act.

Mr. Nicholls : The committee are not going to act, they are simply going to recommend. We will have the fullest opportunity for discussion when this matter is brought forward to-morrow.

The President : Yes.

Mr. Leonard : The only reason I had for bringing the matter up now was, we would want to have this resolution drawn in shape so that it would probably pass without the necessity for having it re-written several times and a lot of discussion which we might or might not have time to go into then.

The President : There may be some difficulty in the case of a member connected with a manufacturing company, where his duties might be partially in the engineering and partly in the selling line. But the National Electric Light Association have had experience and I think possibly we could borrow from the wording of their constitution.

Mr. Nicholls : It does not make any difference in so far as the membership is concerned ; every member whether he be active or associate, has every privilege of the association except that of election to office ; and what I claim is that this primarily should be an association—I am not trying to change, and I don't care which way the vote goes, but as I am here I am saying what I think ; if the others do not think with me I don't feel at all aggrieved over the matter—I understand or did understand it that the object of this Association was to get more particularly central station men and the men whose capital is invested in operative enterprises together for mutual improvement and for protection. I understood that was the motive of it. Whether you have two classes of membership or not, the main motive of my resolution would be to allow only the operative men to be eligible to office. I make that explanation so that as far as my own feeling is concerned, it may not be misunderstood.

Mr. J. J. Wright : However unfortunately the constitution may be worded, as one of the charter members of this Association I distinctly remember at the first meeting that the intention was as stated in the resolution of Mr. Nicholls ; and in regard to any fine cut distinctions as to who should or should not be admitted, all these applications for membership have to be passed upon by the executive committee, and I take it it would lie in the judgment of the executive committee to say whether an applicant for membership should come within either one of the three classes, and which one.

The President : Mr. Wright, what would be your opinion as to the effect of such an amendment on the existing membership ? There are active members at the present time who would not be eligible under this wording. Of course if the amendment was merely that they were not eligible to office that would not affect it.

Mr. Wright : I think the matter would be somewhat simplified if clause 5 is amended in regard to fees. If the amount of the annual dues is changed it will necessitate a reclassification of the whole of the membership.

The President : I will appoint as a committee to draft a proper form of amendment to submit to the convention to-morrow Messrs. F. Nicholls, J. J. Wright, J. W. Purcell, F. H. Leonard, jr., and R. H. Hamilton.

Mr. Nicholls : I would point out that there are three out of the five members who are on the selling end. I have a good many operating interests as well as manufacturing, but I do not attend this convention as an operating man and I would prefer being left off that committee. I don't think the selling end should come here and attempt to influence the deliberations of the active members. I am perfectly consistent in that and I always have been. You appoint all kinds of committees and on this very committee you appoint three out of five from the selling end.

The President : I took this view. I took Mr. Nicholls and Mr. Hamilton as representing the selling end ; I took Mr. Wright and Mr. Purcell as representing the central station men, and I took Mr. Leonard as an engineer connected with neither one end or the other, but standing in the middle, and I supposed that would be a good committee on that account. I tried to make it as neutral as possible.

Mr. Nicholls : Probably I am mistaken. I understood Mr. Leonard was on the selling end.

The President : No, I don't think so. I think if Mr. Nicholls would allow his name to remain, this committee would be satisfactory to this convention.

The President : I have now pleasure in calling upon

Professor R. B. Owens, of McGill University, Montreal, to read his paper on "Transformation from Constant Potential Alternating to Constant Current Alternating."

Prof. Owens read his paper, which was greeted with applause. (See page 29).

The President: You have heard the interesting paper by Prof. Owens, which submits a possible solution of the alternating arc lighting problem. You are all aware of the weak points of the different means used for that purpose, and possibly this will in time offer a solution which will be free from defects. This paper is now before you for discussion.

Mr. Moore: I would like to ask Prof. Owens to give a description of the varied resistances under which these tests were made, whether it was with alternating arcs or with resistances built up in some way.

Prof. Owens: Just a small rheostat inserted with an impedance coil, according to the curve shown in Plate III.

Mr. Moore: The reason I brought up this point is I think it is unfortunate that the investigation was not made with an alternating arc, because the alternating arc has a peculiar property of its own, in that the power factor of an alternating arc is less than unity, without there being a lagging current, this being due to distortion of the wave form and this distorted wave making it very very difficult for a condensor to produce the effect which would ordinarily be expected with the resistances or a varying resistance. I would like to have Prof. Owens' ideas on that point.

Prof. Owens: That would bring up a very interesting point. Any arrangement of this kind with a condensor in series is little affected by the wave form in its operation. In addition to this particular arrangement there are others in which a condensor is in shunt, and such an arrangement is very much affected by change in the wave form. The series arrangement of impedance coil and condensor is I think infinitely better than any shunt arrangement.

Mr. Leonard: Aside from the power factor of the arc, to which Mr. Moore has brought Prof. Owens' attention, there is another practical feature in the operation of series alternating current arcs which those that have had experience with them I think will at least be acquainted with. That is, in order to get a nice feeding circuit of lamps it is a necessity, so far as I have been able to work it out, to have a certain amount of impedance in the circuit, otherwise you get fluctuations, pulsations, or throbs in the light, which destroy the commercial value of the arc, and I don't see that we can do away with that.

Prof. Owens: That is provided for.

Mr. Aldrich: This paper in connection with that by Mr. Robertson this morning has a practical bearing upon the whole question of neutralizing reactance effects in the series type of alternating-current arc light distribution. It has been proven by many experiments with which we are familiar that such neutralization, bringing the power factor of the system practically to unity, enhances the performance of all arc lamps on the given circuit. They are steadier, more reliable and satisfactory than when operated under their usual normal conditions. It is a well-known fact that wave forms influence materially the performance of alternating-current arc lamps. The arc lamp itself will give a most peculiar wave form under certain conditions. Arc lamps can be adjusted for series alternating-current distribution on one generator, at the factory, and it is sometimes almost impossible to get them to work anywhere else till you have gone through another laborious course of adjustments to suit the wave-form conditions of the generator for the service to which the lamps are to be attached. In alternating-current series arc lighting, one is face to face, therefore, with two very difficult, very important and not to say exasperating troubles—one of wave forms and the other of reactance effects and low power factors. Both cannot be killed by one stone, so to speak. But, almost all of these difficulties can be greatly relieved and the whole system brought to a remarkable degree of efficiency and satisfactory performance by the method described by Prof. Owens. A synchronous motor thrown across the line, in parallel (the arc lamps themselves being in series), or even a synchronous generator similarly switched in, will, when operated with a suitably adjusted field excitation, bring the power factor of the whole system practically to unity, giving an unexpected satisfactory performance of series arc lighting service. It has been found by actual experience that such an arrangement of series arc lamps with a synchronous machine is practically equivalent to the method described by Prof. Owens. It will bring the series arc lamps to a remarkable degree of uniformity, regulation and efficiency. In fact, the ideal conditions are thus realized and practical neutralization is effected. The variable load referred to by Mr. Robertson, as being so objectionable in the operation of synchronous motors is here not in evidence. Arc lights are not going on and off every few minutes, as induction motors. When you determine the best operating conditions for given load, with a few minutes' trial, with the rheostat for proper field excitation, you can then set it there over night practically. One or two lights going out will not affect the regulation. The synchronous machine occupies just the relation desired for this work. It has not the inherent disadvantages and limited lagging phase displacement ordinarily found in connection with induction motors. Both of these contributions are on the right track. I think the Association is to be congratulated upon having such practical up-to-date papers as these.

Mr. Layman: I would say this system as described by Prof. Owens comes as near the ideal as anything in practical use to-day, but it is open to one objection and that is that the current is constant. I think the ideal system will be the system in which the current taken from the generator will vary in proportion to the number of lamps in the service.

Prof. Owens: The receiver service is constant: the current from the generator varies.

Mr. Layman: That is the ideal condition.

Prof. Owens: It is not to be taken that this particular apparatus described here is recently developed. One of the objections to synchronous motors is that they are expensive; and of course require attendance. It certainly is to be hoped that before long practical and efficient static condensors will be available: and if they are available to stand high pressure, this system is fairly practicable. We find with the ordinary condensers, you can secure condensers that will stand 500 volts, that means about five lights, and work practically continuously. As to the condenser, you have to make proper provision for ventilation and all that, but there is no reason to suppose that in time we will not have a condensor that will allow a use of several thousand volts, and in the meantime the synchronous motor can be used instead of the condensor up to any size and any voltage.

TOPICAL DISCUSSION ON THE BEST PRACTICE OF CLEANING, TRIMMING AND INSPECTION OF ENCLOSED ARC LAMPS.

By invitation of the President to open the discussion on this topic, Mr. Sangster said: Mr. Chairman, I don't know that I can say very much on this question. Of course, we have a very small plant, and we have had the lamps in use for but a very short time. However, the few remarks I have to make I have jotted down and I will just read them. I wish to say that this is a subject which I think could have been taken up by men of wider experience in arc lighting, seeing I am connected with a small company with a few lights in the back woods in the Province of Quebec, where the lighting and power business has not advanced so rapidly as in our sister province of Ontario. We have had the series alternating enclosed arc lamps in use for almost two years. I can only give our short experience of trimming, cleaning and inspecting. I may say that we did not have much of the summer weather ahead of us when we installed these lamps, and found the first winter harder on the lamps and more difficult in the trimming than it was the past winter, owing to a few defects in the lamps, which the makers kindly helped us to remedy. These defects were found after the first storm, water getting into the works of the lamps; we also found the holder for the outside globe froze to the globe and the screw which made it almost impossible to remove. The current had to be put on for an hour sometimes in order to heat the lamps to enable us to get the globes removed. Owing to the frost and water several of our lamps were destroyed and many globes were broken, these defects were remedied and the past winter was much easier in the matter of trimming and fewer breakages. The shortest days in the winter we trim once in five days, and in the longest days of the summer we trim once in ten days, taking one carbon for each lamp when the trimming is done. The carbons required for these lamps you are all familiar with, being one solid and one cored; they are nine inches long. At the first trimming there is a nine inch carbon put in the upper holder and about six inches in the lower; at the next trimming the carbon from the upper holder is put in the lower one and the new carbon put in the upper—solid in the upper one and cored in the lower—and reverse them at the next trimming. We had a case with 25 inner globes which the trimmer took out with him and brought in the dirty ones. This was when we started on these new lamps, but after carefully watching the lights, I found that the trimmer with care could clean the globes and make them show the light equally as good as new ones. These globes are slightly of the opal kind, we clean them out with a swab of cloth. We have two circuits of 46 lamps each, the trimmer takes one circuit a day. Our circuits are much extended so that he has a horse and buggy for going the rounds. I may say there are many times in the winter when it is impossible to clean the globes; they are then changed and brought to the station, but that is exceptional cases. Some of our lamps are hung on guys in the middle of the streets, others are on arms about 12 feet out from the pole. We raise and lower our lamps by means of a small windlass and wire cable which I have used for about ten years. These windlasses are placed about seven feet from the ground and one handle does for all of them. I had a stool made with glass supports and also covered with rubber and rough glass to protect the man from grounds, and

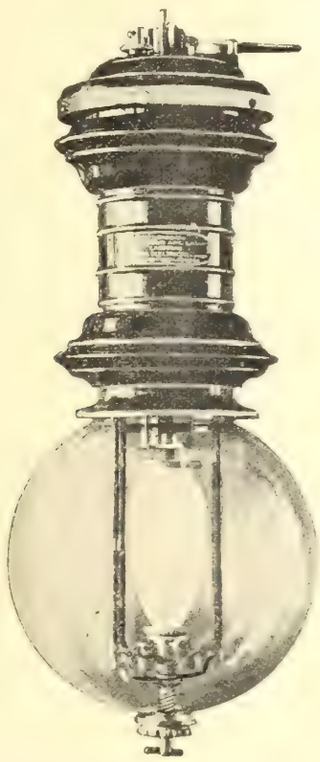
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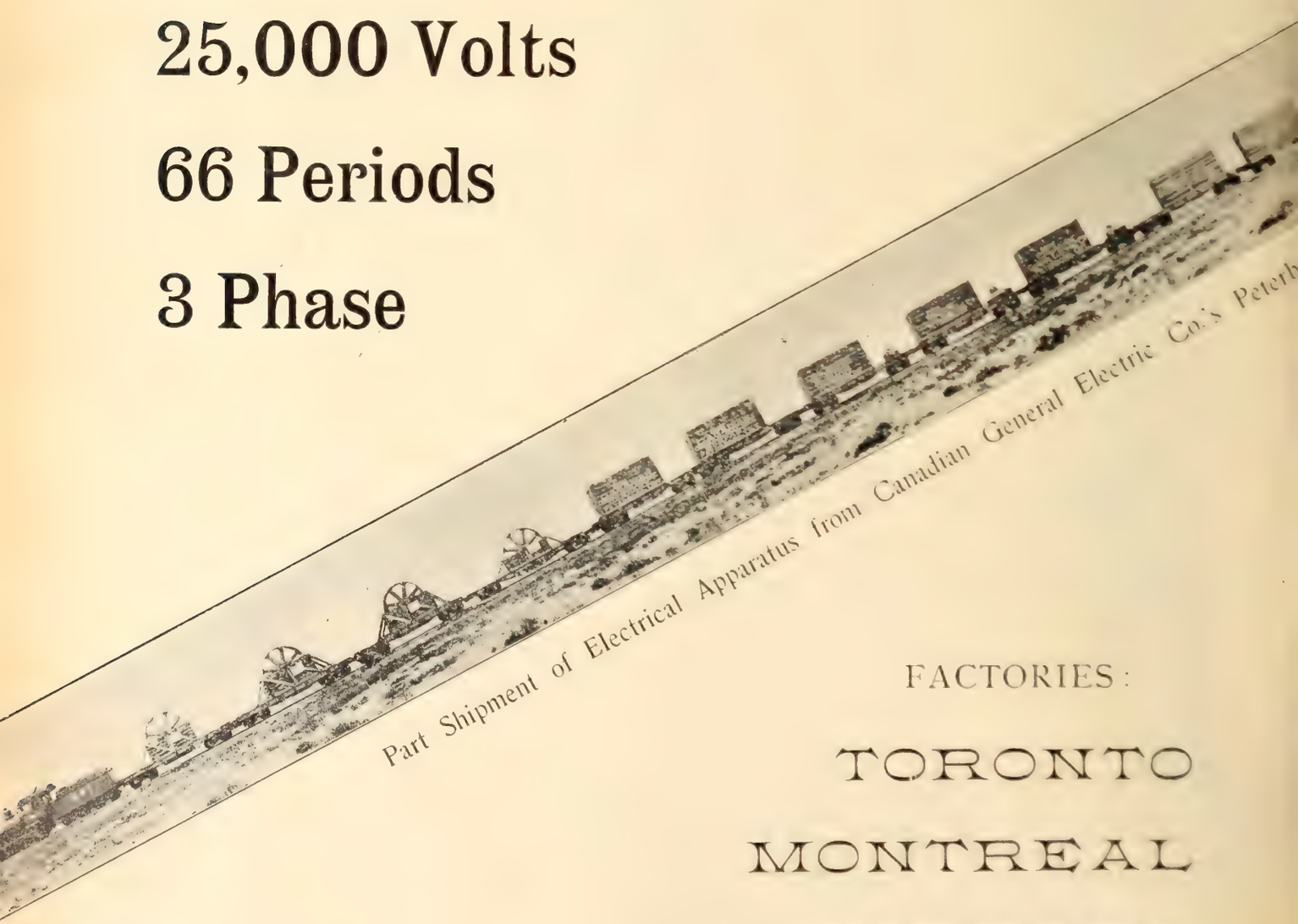
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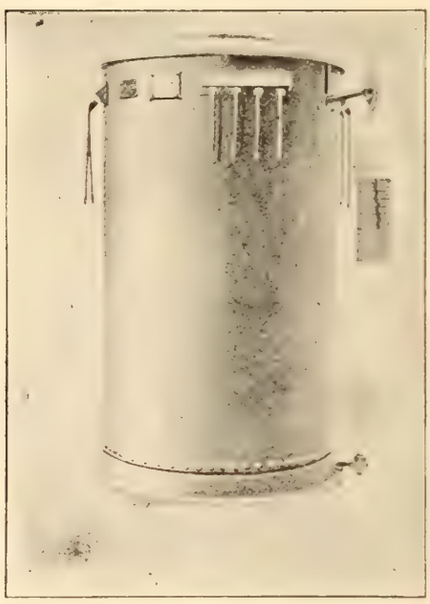
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we have not found any trouble in fixing a lamp when needed. With regard to inspection of lamps, the trimmer goes round when the current is put on the lamps to see if they all start up. There are sometimes in the winter when some of them will stick, but a shake of the cable will generally start them. The number out will average about 20 a month during the winter, and in the summer it is a rare case to have a lamp reported out, as after they are started they rarely go out. When a lamp is reported out two nights it is taken in and repaired. We had 10 extra when we put in the system ; we have still the 10 spare ones, as the repairs have been light since the first winter. We have no patrol man during the night. We make enquiries at the police station if any are reported out. It is only during the winter when an occasional one may be out a short time. I may say the council and citizens are much pleased with the new lamps, and owing to the opal globes the light is not hard on the eyes when driving near the lamp, and yet the light seems to be better and throw further. I trust, gentlemen, that I have not wearied you in these remarks about our arc lighting system, which we think is the best, at least for small plants, and I have no doubt for large ones. I will be glad to show any of you our station should you be in the vicinity of our back woods. (Applause).

Mr. Martin : A great many of you know we have adopted the series alternating arc light system for street lighting. We have had nearly eighteen months' experience, and while we have had our troubles, things are now settled down and are more satisfactory both to the company and to the citizens. When we first started we used the opal inner chambers. They no doubt diffused the light more but they certainly cut it down and we found them harder to keep clean. We are now using a clear inner chamber on all our street lamps. They give a sharper light and more like the old direct current lamps without the shadows. Regards trimming. We have two city trimmers and a patrolman. The trimmers each have a rig which is fitted up with boxes to carry the chambers in, made something after the style of an egg case. There are also pockets for the carbons in these boxes. In the front of the rig he carries a spare lamp and an extra globe or so. Each man has about 210 lamps to look after, he does the changing and any small repairs. We bring in all the inner chambers when trimming and they are replaced with clean ones each time. The ones taken off are returned to the station and are washed in a solution of washing soda and warm water, after being rinsed in clean water they are placed on pegs to dry ready for the next day. We consider this a better way, rather than leaving them to the trimmer to clean on the street as the chances are he will only half wipe them and at his best he leaves them streaked. This goes on from bad to worse and this deposit in the chamber cuts down the light considerably. We use a pear-shaped chamber which has no opening in the bottom, and we find this is better than the open type, inasmuch as it does not allow a current of air to pass through which would reduce the life of the lamp. Of course, ordinary care must be used to keep these tight up to the gas check. The carbons are all passed through a gauge before going out, and only those within the limit .505 to .520 are used, as any over size might cause the lamp to go out by sticking in the gas check, and if under size it will reduce the life of the lamp by letting the gas escape too freely. We find it better to bring in the upper carbons at each trimming, and these are cut the proper length ready for the next day to be used as lower carbons with the new uppers. The idea is to be sure that the carbons are the proper length, for if too long it burns into the gas check, and if too short it shortens the life of the lamp or burns into the lower carbon holder. A word regarding the patrolman. He has a rig and drives round the city twice each night and sees the lamps at least three or four times each. He makes out a report and also marks any lamps to be changed. Each trimmer sees the patrolman's report in the morning and makes any changes necessary. Our commercial trimmer does work very much the same only he has no rig and has to inspect his lights during the forepart of the evening and takes in any city lights on his route, which is right through the centre of the city. (Applause).

Mr. Fisk : I would like to ask how the lamps are put out in Hamilton and whether they have any trouble with open circuits.

Mr. Martin : I don't think we have. We have not had as much, at any rate ; we have been a little more particular ; and the lamps have been put right on the same poles and brackets as the old open arc lights. There is a rope which goes through a pulley on the pole and then there is a hook ; the cleaner has a rope with a hook and he snaps it on and pulls it down.

A member : When using the carbons a second time, and trimming the lamps a second time, what average light do you get on the lamps ?

Mr. Martin : There is no doubt but under the system we use of trimming, the lamp will burn over 80 hours.

The President : What length of carbons do you use ?

Mr. Martin : Ten inch upper, and 5 1-2 inch bottom.

The President : Do you find that the most economical length ?

Mr. Martin : Our lamps are made for that ; that is all we can get.

The President : I suppose the lamps may vary with different makers, but the question I had in my mind was what was the best length of carbon to use, which gave the least waste ?

Mr. Martin : Ten inches seems to be very good because if you use a much longer carbon you get a heavy deposit on the chamber and it cuts down the light.

The President : I had reference to the piece you throw away.

Mr. Martin : We don't practically throw any away. The trimmer practically gets it the proper length.

TOPICAL DISCUSSION ON DIFFERENT SYSTEMS OF CHARGING FOR AND MEASURING POWER CONSUMED BY INDUCTION MOTORS WITH VARYING POWER FACTOR.

The President stated that Mr. Leyden had been asked to open the discussion on this topic, but he not being present Mr. Leonard had consented to speak on it.

Mr. Leonard : I have not prepared myself to talk extensively on this subject, and thought I would be preceded by others who had more practical experience perhaps than I had. I regret very much the absence of the other gentleman who was to speak on this subject. The matter of charging for induction motors is a question of the highest importance to transmission companies, the bulk of whose business may, in the near future, become power business ; and the question of deciding upon a proper rate for charging or metering is something that will interest a good many of us I think now, and probably later will reach almost everybody operating a central power station. Of course, there are a variety of methods before us. There is the method of charging a fixed rate per H.P., and that is in a measure modified by the amount of power that is used on the average. If a man is charged for instance at the rate of $50 a H.P. and he uses his motor perhaps with an average load of half of its capacity it would pay the company a very good revenue. If he used the 50 H.P. continuously through ten hours of the day the company is not making very much money, particularly if the load laps over their incandescent lighting load. In charging a fixed rate for power it has been suggested, and carried out, that the time for using the power should be limited to certain hours so as to prevent lapping on to the lighting load. If consumers can be obtained on this basis, of course the same apparatus which is used to operate the motor load during the other part of the day can be used and the power again sold to other customers for lighting purposes later. Under these conditions a very favorable rate can be made with power consumers, and if proper effort is made in this direction it seems to me a large amount of power could be connected to the central station on a paying basis not only to the lighting company but to the consumer of power. The rate can be made enough lower to make it an inducement for a man to shut off his power at an earlier time in the day, as touched upon in Mr. Robertson's paper. Mr. Robertson covered so fully and exhaustively and in such concise language the whole subject that it leaves very little to be said now. The method of charging on a meter basis for motor load is necessarily a heavy tax on the consumer of power because if a man is allowed to use his motor at any hour of the day the central station must protect themselves by having sufficient apparatus to supply not only during the hours outside of the lighting load, but enough in addition so as to carry them through the peak of the lighting load ; apparatus, in other words, must be supplied to furnish current for lights and motor load as well and under such conditions the companies must have a price which will pay them for carrying this reserve apparatus. The subject is one that would admit of considerable discussion, and I would like to hear from some of the central station men who have had a little experience with this matter. Perhaps Mr. Robertson can give us a suggestion.

Mr. Robertson : I think after what I said this morning there is very little that I could suggest that would be of interest. As you all know most central stations do not provide motors for their customers. In a few isolated cases they have done so, but in the great majority of cases the customers have to get their own motors. If a customer buys his own motor it all depends on where he gets it what power factor it has. A customer may buy a motor with a power factor of 100 or 75, which means a considerable difference in capacity the supply company must provide and keep for his use. While it has been usually the practice to sell power on a basis of true energy, it would, I think, be more equitable to sell the power on a volt-ampere basis and then it would be to a customers' interest to get as good a motor as possible. If a customer had skilled operators available and felt

like putting in a synchronous motor he could operate with a power factor of unity, and as ehis would be of considerable advantage to the central station, I think it would be worth while to offer a slightly reduced rate to such a man. It seems to me there is a point somewhere between charging on a true energy basis and on a volt-ampere basis, that would be more equitable than the present system.

Mr. Nicholls : I would like to get the experience of the central station men as to the possibility of getting customers to take power during certain hours of the day ; for instance, a manufacturer shutting down at four o'clock or before the peak of the lighting load commenced, in order to get a rebate in price from the central station company. While a manufacturer might be perfectly willing to do that would it be possible for him to be able to induce his employes to work under these conditions ? In other words, if you are going to get the full weeks' work, whatever it is, if you close down at four o'clock you would have to compensate for that time by starting early in the morning or giving up the Saturday afternoon holiday. Mr. Reesor and Mr. Fisk both come from points where there is considerable manufacturing and would know probably the position of affairs with the manufacturers there.

Mr. Sangster : I may say with regard to our plant, we are trying to obtain customers to whom we can supply power in the winter time up to four o'clock. We have quite a few of them in that way. We average about 90 H.P., down to 1. During the winter months, from October to March, we get them to shut off at four o'clock, and we have found no difficulty in doing that. It is mostly places where there are grist mills and things of that kind that we have any difficulty ; and then we have four or five newspaper presses, where they are using it ; they are very often shut off at four o'clock. So that we are able to do it in that way. By giving them a lower rate we are able to get customers in that way.

Mr. Reesor : Our experience so far has been somewhat limited ; we have not got up to the capacity of our generator as yet, and we have not had occasion to have any of them shut down, but with nearly all our contracts they do not run the 24 hours of the day ; we try to persuade them to enter into an agreement to allow for shutting them down at the peak load, and so far we have had no difficulty whatever. The printing presses and smaller powers get their work done usually before that time. We allow them to do this. Instead of running those hours we sometimes allow them to run over time at some other time : that is, after night. One press in particular we have that runs nearly all night for the purpose of getting their paper, which is a weekly edition, off early in the morning ; they do that once a week. We have had no difficulty so far. But we have got two flour mills running by electricity and one of them runs pretty regularly the year round, 24 hours a day. Of course we can't ask them to shut down. As to the other mill, the arrangement we made with them was that they were to run in the day time only, except sometimes in the later fall they want to run all night. We do not restrict them so long as we have power to spare, and, as I have said, we have not yet got up to the limit of our power ; we have more power in reserve and should we get up to the limit of our capacity no doubt we would put in the other unit that we have. In that way we will have capacity to run everybody in the town for a number of years to come. I think the idea is all right to have an arrangement to have the power shut down at the peak load ; but it is a good deal like the lighting, people that are busy do not like to shut down for anything ; and of course there may be difficulty bye-and-bye but we have not crossed the river yet, and we are not going to court trouble until we get nearer to the end of our tether.

Mr. Leonard : I might add a word more on this question of short hour power. One of our clients who is using a total capacity of about 3,500 H.P. in motors has made a contract which is such as we have been talking of for the use of power during short hours ; that is, the terms of the contract provide that the company shall not use power between the hours of four and seven in the winter months ; they are at liberty to use the power at any other time all day during the summer, and all night if they wish, and all day up to four o'clock in the winter, and all night after seven o'clock if they wish. This was considered as quite an experiment to begin with on account of the large number of help employed, but in order to get in a full days' work the mill started earlier in the morning and worked nine and one half hours during the winter months every day in the week, except Sundays of course, and that cut off their Saturday afternoon holiday, that is up to four o'clock ; but they had after four o'clock off every afternoon in the week. And in the summer time while the power is available during all the hours up to six o'clock we run to six o'clock and give them a half holiday Saturday afternoon. The idea that the help have in connection with this method of operating can be seen from the fact that one of the departments which was capable of operation independently of the rest of the mill petitioned to have those hours continued during the summer time so that they could get to work early in the morning and quit early at night, having all the rest of the time after four o'clock ; and that department was allowed to run on in that way. So that I think it has got beyond the experimental stage so far as the help is concerned ; I think they would be better pleased at working those hours. The help are simply very well pleased with this arrangement and I don't see any reason why it should not be carried out very generally and I think a large amount of power business can be worked up on that basis.

The President : I have here a map which has been handed to me by Mr. Thomas C. Keefer, former president of the Canadian Society of Civil Engineers, which has been printed by the Department of Ontario and which was used by Mr. Keefer to accompany an address which he made before the Royal Society of Canada, as to the water powers of Canada. He tells me that there is no other map in existence which shows the water powers of Canada like this does, it is very complete and very accurate. It shows every stream of any importance in Canada, its correct location, its elevation and also the amount of rainfall, and the annual average rainfall of each locality. To anyone who has anything to do with water power or is looking for water power or wishes to develop one anywhere, the general knowledge to be gained by this map he thinks would be quite considerable, and he left this here for the inspection of the members and stated if any of the members desired to have a copy all it was necessary to do was to leave the names with the Secretary and Mr. Keefer would be pleased to have the Government forward them a copy by mail. (Applause).

Mr. Holman moved, seconded by Mr. F. H. Leonard, that a vote of thanks be extended to Mr. Thomas C. Keefer for his courtesy in the matter of extending to the members present the mailing of a copy of this map. Carried.

Mr. J. J. Wright moved, seconded by Mr. F. Nicholls, that the thanks of the Association be tendered to Prof. Owens for the interesting paper read this afternoon. Carried.

Mr. A. B. Smith moved, seconded by Mr. J. J. Wright, that the usual amount of $125 be granted to the Secretary of this Association. Carried.

The convention adjourned to Friday, June 21st, at 10 o'clock a.m.

THIRD DAY.

At 10.15 o'clock a.m., the President in the chair, called the convention to order.

The President : The first order of business is the report from the committee appointed yesterday to draw up an amendment to Articles 3 and 5 of the constitution regarding membership.

Mr. J. J. Wright : Your Committee on amendment of the Constitution beg to report as follows :

That Article 3 of the Constitution be stricken out and the following substituted : "The Association shall consist of honorary, active, associate and junior members. The terms 'active members' shall include all those actively engaged in operating electrical enterprises, electrical engineers and those engaged in matters of electrical education. The term 'associate' includes all others applying, whom the Executive Committee consider eligible to become members of the Association. They shall be entitled to attend all meetings of the Association except those of the Executive and take part in all discussions, but shall not be entitled to vote for the election of officers or be eligible for office.

'Junior membership' shall be confined to those pursuing the studies of electrical engineering ; and no person shall be eligible for this membership for a term exceeding two years, after which they may apply for active or associate membership. Honorary members shall only be elected by a two-thirds vote of the active members present.

It is recommended that for Article 5, at present in the Constitution, the following be substituted : "The annual fee shall be for active and associate members $3, the Executive, however, being authorized to increase this fee to a sum not exceeding $5 at any time they may deem it expedient in the interests of the Association. The fee for junior members shall be $1 per annum payable in advance."

Mr. J. J. Wright : I may say that the committee after giving the matter full consideration were unanimous in making this recommendation. It will be seen that the privileges of the associate members are extended by giving them the opportunity to vote in all other matters except the single one of the election of officers.

The President : You have heard the report. This has to be approved by two-thirds of the active members present before it can become law. I would like an expression of opinion on these amendments because since the matter was brought up yesterday afternoon a number of members have spoken to me about some of the features contained

in these amendments and in doing so brought out some new points which were not made known to me yesterday. I think we ought to get all possible light upon this subject ; it should not be decided hastily and I would invite a very full discussion. This matter should be settled now for good and we should get the full sense of the meeting.

Mr. J. J. Wright moved, seconded by Mr. Fred. Nicholls, the adoption of the report.

The President stated the motion.

Mr. Geo. J. Hicks : Referring to Article 10 of the Constitution, the 5th clause distinctly states that this report cannot be considered to-day, and I submit that the discussion on it to-day is out of order.

The President : This is a very unfortunate rule, and I realized it last year when some matters were discussed. It makes it practically impossible to amend the Constitution unless you start the very first morning.

Mr. Fred. Nicholls read Article 14 of the Constitution.

The President : This matter has been up since yesterday. There was a notice of motion given and discussion took place. Everybody knew this was coming up this morning ; not a word of protest has been raised to the legality or illegality of the thing, and now we discover, according to the strict reading of the Constitution, the report should not be considered to-day. I think these safeguards are placed there to prevent any hasty legislation or any advantage being taken of a member who is not present at the sitting ; but these things do not apply, because there has been such full notice of this action that everybody has heard of it and knows about it and expected it to be settled this morning. Under the circumstances, if it is the unanimous wish of the meeting—if there isn't a dissenting voice—I would take it upon myself to interpret the Constitution in that way, that we can set it aside for this purpose. I think it would be quite within the proper practice. (Applause).

Mr. Nicholls : I might point out while the Constitution in all corporate companies provides that you give ten days' notice of a special general meeting or annual meeting by such notice as is provided for by the by-laws, yet you can waive that notice altogether, even although the statute calls for it, providing you have every shareholder's consent to it ; and that is frequently done in the organization of companies, by having a waiver from every shareholder of the notice of the meeting. In this case, if there is an unanimous vote, that notice I think can be waived, but in the event of there being a dissenting vote, even one, I think we will have to carry out the strict reading of the Constitution.

Mr. Hicks : I would agree with Mr. Nicholls' remarks if every shareholder would waive that point ; that it would be perfectly right to deviate from the regular order; but this matter was brought up yesterday and every member of the Association is not present to-day, and I personally know one gentleman who left the city last night knowing this could not be discussed to-day. I must personally raise my objection to it.

Mr. Nicholls : I would state that probably the only way to get over the difficulty would be to have the President call a special meeting for to-morrow ; that is if the general sense of the meeting is in favor of the passage of the amendments.

The President : I think it would be well to take the sense of the meeting because if the sense of the meeting was against it there would be no use calling the meeting.

Mr. J. J. Wright moved, seconded by Mr. E. E. Cary, that when this meeting adjourns this morning that it stand adjourned until to-morrow. Carried.

Mr. Nicholls : In order to test the sense of the meeting I would suggest that the yeas and nays be taken upon the principle as outlined in the amendments that it is proposed to bring before the meeting of the Convention at its session to-morrow morning.

Mr. Leonard : I would second a motion to that effect.

The President : This is a large gathering, and I think it is very desirable that the feeling of the members should be known upon this point. This Association has to be governed in accordance with the wish of the members and we desire to know what their wishes are.

The President asked those in favor of the Constitution being amended in accordance with the report of the Committee to signify it by rising.

The members rose unanimously, with the exception of Mr. Hicks.

Mr. J. J. Wright : I asked that the contrary vote be called for.

The President called for the contrary vote. (No response).

The President : The next thing we have to deal with is the selection of the place for holding the next convention. I may state in justice to Mr. Evans, of Quebec, who attended the first day and was compelled to go away, that he left in my hands an invitation to the Association to meet next year in Quebec.

Mr. G. U. G. Holman : My residence is in Quebec, but the business of my company is on the other side of the river ; however, I want to second Mr. Evans' invitation, and I hope you will hold the next convention in Quebec. As far as my company and myself are concerned we shall be very, very happy to make your stay there a pleasant one and we will try to come up to the hospitality that Ottawa has given you.

Mr. John Yule : I move, to test the sense of the meeting, that the next convention be held in Toronto. As far as I am concerned I have my doubts as to a meeting in Quebec being successful in point of attendance. It is a little too far to one side for those who usually attend. There would be a large attendance in the neighborhood of Quebec. We have been in Montreal and Kingston, and we are east again this year, and I think the west ought to get a turn. It is very central in Toronto for the whole country, and a meeting there I think would be a successful one.

Mr. F. Nicholls : While I may say, speaking for Toronto's interests, that we would be very glad indeed to welcome the Association there next year, I really think we will be in a very much better position to do so say a year later. We are having a new hotel built at the present time which will not be finished next year, but I think it will be finished and will give first-class accommodation to the convention if they will meet there a year later. At first I was inclined to Mr. Yule's opinion that we might prejudice the attendance if we went so far east ; and the travelling expenses are very considerable. These things have to be considered as an important factor ; in fact they are a very serious power factor with them. But I think we might probably be affected in another way, and while for one session we might lose the attendance of some of the active members from the west the chances are that we will get a very large attendance from the district of Quebec of central station men that never yet have attended unless they became members. That is a question that some of the Montreal and eastern men can tell better than I can. I do not know but what the end might justify the means and we might get an increased membership there ; and if we met in the west another year when we had every facility to take care of the members it would probably be better. However, should you decide to come to Toronto both Mr. Wright and myself will do all we can to make the stay of the members pleasant and profitable.

The President : Two places have been mentioned for holding the next convention, the City of Quebec and the City of Toronto. Unless you have some other place forthcoming I shall call for a ballot and I will appoint Mr. Thornton and Mr. Purcell to act as scrutineers.

Mr. J. J. Wright : Is it in order to move that the acceptance of the invitation from Quebec be made unanimous ?

Mr. Yule : I would be pleased to withdraw my motion. It was simply made for the purpose of getting an expression of opinion.

The President : Mr. Yule withdraws his motion so that the City of Quebec will be our next place of meeting. (Applause).

Mr. Nicholls : As the Constitution provides that this should be decided by ballot, I move that a single ballot be cast by Mr. J. J. Wright. (Mr. Wright cast the ballot).

The President : I am personally gratified that you have chosen the City of Quebec. I know something about that city and I am satisfied that you will get a very fine reception there. The people of Quebec are noted for their hospitality and I am sure the convention there will be a success and will be worth the few dollars you will be asked to spend in order to go a greater distance from home. The next order of business will be the election of officers, and I will ask Mr. Thornton and Mr. Purcell to continue as scrutineers. I will now receive nominations for the office of President of the Association.

Mr. F. H. Leonard, jr. : It gives me much pleasure to nominate for the office of President of this Association for the ensuing year our present vice-president, Mr. E. E. Cary.

Mr. E. E. Cary : I appreciate the nomination from Mr. Leonard, but before passing it in I wish to say as a member attending upon the convention at Hamilton that I am specially pleased with the provisions for the amendment of the Constitution which I regret could not be carried out to-day, because those who were present at Hamilton will recollect a discussion that took place as to whether supply men were eligible to the offices of this Association. In the past a number of them had served upon the Executive Committee, but I believe it happened that no one engaged in manufacturing or who was called a supply dealer had ever been elected as an officer of this Association, and a discussion took place at that time and resulted in a difference of opinion, and, although a supply man was elected as an officer of this Association, I feel we should all be a unit, and the amendment of the Constitution will settle that matter, and it will be acting in ac-

cordance with our sister Association on the other side. Therefore, I beg to decline the nomination, and I have great pleasure in nominating Mr. P. G. Gossler, of Montreal, for the office of President of this Association.

Mr. F. Nicholls : In rising to second the nomination of Mr. Gossler, if I am not out of order, I would like at this stage of the proceedings to move a vote of thanks to Mr. Cary, the retiring first vice-president, because to my knowledge he has been a most active member of the Association for a great many years and has always taken a very active interest. Although I am a supply man myself, I have taken the stand I have done in regard to the artive men because I believe it is in the interests of the Association ; I believe it is the only way the Association can grow and thrive and become of value to the interests which it represents. I have very much pleasure in moving a vote of thanks to Mr. Cary for his past services. (Applause).

Mr. Cary : Many thanks.

Mr. John Murphy : If a seconder is necessary, it gives me great pleasure to second the motion proposed by Mr. Nicholls. A convention without Mr. Cary would not be right. (Applause).

The President put the motion and it was declared carried by a unanimous standing vote.

Mr. Cary : I might say in sympathy with our absent friend Mr. Gossler that my mind was on him at that moment.

The President : Mr. Cary, you have heard the result of the motion which has been unanimously carried with enthusiasm. It gives me very great pleasure to tender to you the thanks of this Association. I do so with all the more pleasure because having been associated with you in the Executive Committee, you being First Vice-President, I have learned the value of the services which you have rendered the Association, not merely at the convention, where everyone would see you, but between conventions when you were not working publicly, but nevertheless, doing valuable work for the Association, and for which I have had occasion to be thankful. I regret that circumstances prevent you from filling the Presidential chair, which you would have so ably filled, and the action you have taken in this matter is on a par with what you have always done for the Association. Are there any other nominations ? There being none I declare the nominations closed, and I will instruct the Secretary to cast a ballot for Mr. P. G. Gossler as President of this Association for the incoming term. (Applause). At this stage I would like to ask your permission to interrupt proceedings and allow Mr. Higman to present his motion with regard to the banquet.

Mr. Higman : It is not necessary for me to re-state my views. I placed them before you somewhat positively yesterday. I may just say this, however, that for the past ten years we have been devoting from $100 to $150 a year for this banquet. I am of opinion if this money were devoted to the building up of a library for the Association or the distribution of literature among the members of the Association or even applying it to our friend's committee for legislation work that it would be infinitely better spent than it is for the purpose of a banquet. I will therefore move, seconded by Mr. J. J. Wright, that the funds of this Association be not hereafter used for the purposes of entertainment at the Annual Convention either by means of a banquet or otherwise, but that the local entertainment committee at the place where the convention is held be permitted to make such arrangement for entertainment as they may deem expedient and necessary.

Mr. Nicholls : There is one question I would like to ask. You specify that the local committee make arrangements for a banquet, but according to that it would seem to shut out the members of the Assoc ation from at any time having a banquet of their own by an assessment for a ticket. That is not intended.

Mr. Higman : No. It leaves the local committee free to do whatsoever they please. For instance, we have collected $300 on this occasion outside of the grant. If we had provided a luncheon at the Victoria Hotel at Aylmer which the ladies could have attended, we could have done it very nicely out of the amount collected by the local committee without touching the Association funds at all. I don't think it will deprive us from any of our pleasure by adopting a resolution of this kind.

The President : There is a point that ought to be brought out in connection with this. It seems to me that the banquet ought to remain on as an annual feature or be abolished as a free banquet positively. This is the position of a city where the convention is to be held : There has been a banquet every year, for which no charge has been made ; that is the custom. No one cares to depart from the annual custom and if the convention was to be held in Ottawa next year I would feel bound to continue that practice. Nobody likes to take the first step and change this and perhaps be accused of want of hospitality. In order to remove such embarrassment, if it is decided to do away with the banquet as a special feature, we ought to state it and say this Association will not countenance any free banquet, and then that ties the hands of the local committee in Quebec so that there is no option and they must charge. Otherwise they might feel bound to carry on the usual custom and, not receiving any assistance fram the Association, we would be placing an additional burden upon them.

Mr. J. J. Wright : It is rather unfortunate that this has been mentioned after the place of meeting has been fixed upon. It looks rather ungracious to fix the place of meeting and then say to them, you are not going to get any more from us.

Mr. Higman : I consulted Mr. Evans yesterday and he said he was quite in sympathy with the motion. The notice of motion was given before the place was determined upon. Mr. Evans thinks the funds of the Association should not be used for the banquet.

Mr. B. F. Reesor : This discussion is probably a little too early, but how would it place the local committee, the parties getting up the banquet, when there is a charge being made ? They wouldn't know how many seats to provide for or anything at all.

The President : I think that could be gotten over all right.

Mr. F. H. Leonard, jr. : Mr. President, I think the question of a banquet is one that is already settled. I don't think there is any doubt but what we shall continue to have banquets in the future just as we have in the past ; they are one of the pleasantest features of our gatherings and I am sure for my part I should not hesitate to contribute my share ; and as has been the case before the entire cost of the banquet has not been borne by the Association, and I presume funds will be collected outside which would assist the committee or whoever has charge of that matter in carrying out the banquet and giving us just as sumptuous a feast as we have had before. Of course, if the rule is made, whether it is passed by resolution or made part of the by-laws, or otherwise, that each member shall pay one dollar, we will say, for a ticket for the banquet, or has the option of paying it, there will always be funds enough raised outside of that to put up a first-class feast. I am in favor of Mr. Higman's motion, and I only wish to express myself in this way so as to let the members realize that we are not going to go without a banquet in the future.

Mr. Higman : We may amend this by simply making it read that the funds of the Association shall not be used for the purposes of entertainment. I would not ask to deprive anyone from any enjoyment. Those resident in Ottawa, when the Civil Engineers had their meeting in this place, subscribed all the way from one dollar up to ten dollars apiece, and covered the whole expense without going out of their own body in the city and they put up a very good entertainment throughout ; and I don't think there will ever be any difficulty so far as this Association is concerned in getting plenty of the good things that are going even if this resolution is passed ; and, seeing that we are always hard up for funds, I do hope the Association will favorably construe this resolution. I am quite willing to amend it by stopping at the words "That the funds of this Association be not hereafter used for purposes of entertainment".

The President : I may say that, from my own standpoint, I think as much of the banquet as anybody here and I would be sorry to see it dispensed with as an annual feature. It is the social function of the Association and the place where we all fraternize, but I would like to say to the Quebec members that I would much rather buy a ticket to a banquet in Quebec than have it offered free of charge. (Applause)

The President put the motion as amended that the funds of this Association be not hereafter used for the purpose of entertainment, which, on a vote having been taken, was declared carried.

A telegram was read from Mr. P. G. Gossler, of Montreal, regretting his inability to attend any further sessions of this convention.

Mr. B. F. Reesor : I think it would be a nice thing for the Secretary to send a telegram to Mr. Gossler saying that he has been unanimously elected as President of this Association. (It was so ordered).

The President called for nominations for the office of First Vice-President.

Mr. Vule placed in nomination Mr. B. F. Reesor, seconded by Mr. E. D. McCormick.

Mr. John Murphy moved, duly seconded, that the nominations close. Carried.

The President : I have much pleasure in declaring Mr. B. F. Reesor, of Lindsay, elected to the office of First Vice-President of this Association. I may say from having come in contact with Mr. Reesor in the Executive Committee that the Association has made a very wise choice.

The President called for nominations for the office of Second Vice-President.

Mr. E. E. Cary placed in nomination Mr. Edward Slade, of Quebec City, seconded by Mr. O. Higman.

On motion, duly seconded, the nominations were closed.

The President : I have pleasure in declaring Mr. Edward Slade, of Quebec City, elected to the office of Second Vice-President of this Association.

The President called for nominations for the office of Secretary-Treasurer of the Association.

Mr. Smith placed in nomination Mr. C. H. Mortimer, seconded by Mr. B. F. Reesor.

On a motion duly seconded, the nominations were closed.

The President : It gives me very great pleasure to declare Mr. Mortimer elected for the twelfth time Secretary-Treasurer of this Association. I think possibly Mr. Mortimer, in accepting re-election, will feel relieved that a new president has been elected, because during the year I have been particularly hard on him. The correspondence with him has filled quite a little volume.

The President : The next thing in order is to select out of the members of the Executive Committee of the past year five members who are to remain on, allowing the other five to retire.

Mr. O. Higman : I would ask that my name be omitted from the list this year.

Voices : No, No.

The Secretary passed the ballot.

The President : While we are waiting for the result of the ballot I might announce to you that the Local Manager of the Bell Telephone Company sends a cordial invitation to the Association to visit their building after adjourning this morning. (Applause).

Mr. John Murphy moved, seconded by William Ahearn, jr., that the thanks of this Association be tendered to the Corporation of the City of Ottawa, the Directors and officials of the Ottawa Electric Railway Company, the Directors of the Ottawa Electric Company, the Ottawa Power Company, the Bell Telephone Company, the Great North-Western Telegraph Company, the Hull Electric Company, the Capital Power Company, Mr. T. C. Keefer, and to Messrs. Ahearn and Soper for the generosity and kindness shown to the members of the Canadian Electrical Association during this the 11th annual convention. Carried unanimously.

The President announced the names of the five members re-elected on the Executive Committee as follows : Messrs. J. J. Wright, Toronto ; John Yule, Guelph ; A. B. Smith, Toronto ; W. H. Browne, Montreal ; and Ormond Higman, Ottawa.

The President called for nominations for five new members to be elected to complete the Executive Committee.

Mr. A. B. Smith placed in nomination Mr. A. A. Dion, seconded by Mr. F. Nicholls.

Mr. G. L. Hicks placed in nomination Mr. J. W. Purcell.

Mr. F. Nicholls placed in nomination Mr. A. Sangster.

Mr. J. Yule placed in nomination Mr. J Murphy.

Mr. R. M. Robertson placed in nomination Mr. F. H. Leonard, jr.

Mr. Leonard : I beg to decline. I do not care to act on the Executive Committee, as I prefer to see central station men pure and simple act there..

Mr. Murphy : On account of Mr. Leonard's diversified connections I think he should be on the Committee.

Mr. B. F. Reesor nominated Mr. F. Simmons.

Mr. J. J. Wright nominated Mr. R. M. Robertson.

Messrs. W. G. Holman, Professor Owens and K. B. Thornton were also nominated.

On a motion, duly seconded, the nominations were closed.

The President asked Messrs. Fisk and McCormick to act as scrutineers.

Mr. J. J. Wright asked the President, Mr. A. A. Dion, to vacate the chair, and requested Mr. Leonard to take the chair.

Mr. J. J. Wright : It is no doubt very apparent to you why I was so anxious to forestall the result of the elections in many ways and get Mr. Dion out of the chair as quickly as possible. It is simply for the purpose of asking you to endorse a resolution that the heartiest thanks of the Association be tendered to Mr. Dion for his services to the Association during the past two terms. Not only this year but last year under extremely difficult circumstances Mr. Dion has spent a great deal of his time, which has been taken from very important matters, as you are no doubt well aware, to further the interests of the Canadian Electrical Association. I have much pleasure in moving that the most cordial and hearty thanks of the Association be tendered to Mr. Dion for his services in the past. (Applause).

Mr. Fred Nicholls : Mr. Chairman, I feel it quite a privilege to be asked to second this motion. I made some little reference to Mr. Dion and his ability as presiding officer, at the banquet last night I have been at a very great many meetings of different kinds, and I must say the dignity and acceptability with which Mr. Dion has presided at these meetings would be difficult to surpass. I have much pleasure in seconding the motion that a hearty vote of thanks be tendered to Mr. Dion as the retiring President of this Association.

Mr. Leonard : Gentlemen, you have heard the motion.

Mr. Nicholls started singing "For he's a Jolly Good Fellow," in which he was joined by all the members present, after which three cheers and a tiger were given for the retiring president, and the motion declared carried unanimously.

Mr. Leonard left the chair, President Dion resuming.

The President : I would find it difficult to express to you my appreciation of your kindness in the demonstration you have just made in my behalf. I can assure you I have deemed it a great honor to be elected to the Presidency of this Association when there are so many other men in it with more experience and who were more worthy of filling the chair than I was. When I was re-elected for a second term I can say I really did not desire it because I was under the impression, and I am still, that it is more advantageous to a society of this kind to change its president every year. However, last year circumstances seemed to make this desirable in the view of some of the members and I consented to serve a second term and I may say during this time the work connected with the office has been a labor of love and I feel it doubly so when I find anything I have been able to do is so well appreciated by the members of the Association. I thank you very much, and I regret to leave this chair, I feel so well in it. However, in one sense I am glad to give the opportunity to some one else to do the work, as my own private work has left me very little time to devote to the Association, and will leave me very little time during the coming year, but it is my purpose to stick just as closely and to work just as hard for the interests of the Association as if I were filling the presidential chair. (Applause).

The President announced the names of the five new members elected to the Executive Committee as follows : Messrs. A. A. Dion and J. Murphy, Ottawa ; A. Sangster, Sherbrooke, Que. ; W. G. Holman, Quebec, and K. B. Thornton, Montreal.

The President asked if there was any other business to bring before the convention. There being no response, he declared the convention adjourned until Saturday, June 22nd, at 10 o'clock, a.m.

FOURTH DAY.

The meeting opened at 11 a.m., the President, A. A. Dion, in the chair.

Moved by John Murphy, seconded by W. G. Bradley, and resolved, that in accordance with the proceedings taken during this convention with regard to the amending of Articles III and V of the Constitution of this Association, the said Articles be and are hereby rescinded, and shall be and are hereby replaced by the following :

Article III.—Membership.—The Association shall consist of honorary, active, associate and junior members. The term "active member" shall include all those actively engaged in operating electrical enterprises, electrical engineers, and those engaged in matters of electrical education. The term "associate" includes all others applying whom the Executive Committee consider eligible to become members of the Association. They shall be entitled to attend all meetings of the Association except those of the Executive, and take part in all discussions, but shall not be entitled to vote for the election of officers or be eligible for office. Junior membership shall be confined to those pursuing the study of electrical engineering, and no person shall be eligible for this membership for a term exceeding two years, after which he may apply for active or associate membership. Honorary members shall only be elected by a two-thirds vote of the active members present.

Article V.—The annual fee shall be for active and associate members $3.00, the Executive Committee however being authorized to increase this fee to a sum not exceeding $5.00 at any time they may deem it expedient in the interests of the Association. The fee for junior members shall be $1.00 per annum, payable in advance.

No other business being forthcoming, the President declared the convention closed.

Dominion Electrical Standards.

By O. Higman, Ottawa.

In 1894 when Parliament passed The Electrical Units Act (Schedule A.), the writer was called upon to procure the apparatus necessary to produce and express the standards therein legalized.

In seeking for guidance in the discharge of this important and responsible duty, I naturally turned to the brilliant work accomplished by the Committee on Electrical Standards appointed by the British Association in the seventies, and the no less brilliant work accomplished by the Electrical Standards Committee of the Board of Trade and contained in their report to Parliament in 1891-92. The results of the labors of these committees will, I venture to say, be found to be one of the most interesting and instructive chapters in the history of electrical science. At the period when they commenced their labors the experimental sciences of electricity and magnetism were, for the most part, mere collections of qualitative results estimated by means of units which were altogether arbitrary. The work of the committee changed experimental electricity into an exact science by adopting the C. G. S. system as their fundamental basis and enabling them to express their results in units that are altogether independent of instruments or surroundings. For practical purposes, however, it was necessary that the units should find expression in apparatus the accuracy and constancy of which could not be questioned. For the measurement of current and electro-motive force, both varying and unvarying, Lord Kelvin's instruments were recommended. The following apparatus has been procured by the department as Standards of Electrical measure and although not by any means complete, I am glad to be able to report that substantial progress has been made in complying with the requirements of the section 3, of The Units Act.

STANDARDS OF RESISTANCE.

Three standard ohms, two of the Board of Trade and one of the Reichsanstalt (Berlin) pattern.

One resistance box containing ten 1-ohm coils with suitable plugging arrangements for putting the coils in series as a 10-ohm standard or in multiple as a 1-10-ohm standard.

One Kelvin resistance coil 100,000 ohms with 10 sub-divisions of 10,000 ohms each arranged with plugs for connecting in series or in parallel or any combination of series and parallel.

One Wheatstone Bridge (Anthony pattern) with ratio coils 1, 10, 100, 1,000 and 10,000 on each side with bridge coils of tenths, units, tens, hundreds and thousands. These coils are made of manganin specially selected and the box is fitted with an electric thermometer. Measurements of great accuracy can be obtained with this bridge used in conjunction with a sensitive reflecting Darsonval galvanometer. Intercomparisons between these standards will be made from time to time and records kept of their variations.

MEASUREMENT OF CURRENT.

For the measurement of current a set of Lord Kelvin's balances has been provided, covering the following ranges:

0 to ..... 1 ampere,
1 to ..... 5 "
5 to ..... 25 "
25 to .....125 "

1 Watt balance, 100 amperes and 200 volts.

These instruments are founded on the mutual forces, discovered by Ampere, between movable and fixed portions of an electric circuit. The shape chosen for the mutually influencing portions is circular and are called by Lord Kelvin "Ampere Rings." In each of the instruments each movable ring is actuated by two fixed rings, all three approximately horizontal. There are two such groups of three rings—two movable rings attached to the two ends of a horizontal balance arm pulled, one up and the other down by a pair of fixed rings in its neighborhood. The current is in opposite directions in the movable rings to practically annul disturbance due to horizontal components of terrestrial or local magnetic forces. It is fortunate that these magnetic disturbances have been thus annulled for reasons that will be alluded to presently. In all of the balances the current goes in opposite directions through the two fixed rings, so that the movable ring is attracted by one of the fixed rings and repelled by the other. The balances were constructed specially for the department and are a modification of the ordinary type. They are intended as ultimate standards, great accuracy and permanency being guaranteed. The scale and sliding weights are taken away and the beam is made specially strong and has a pointer at each end. A scale pan is hung at each end of the beam, and the distance from coil to coil is greater than in the ordinary balance. The method of making an observation is by placing a weight of fixed amount on the left-hand scale pan, and the beam is balanced with no current through the coils; the weight is then lifted to the right-hand scale pan and the current turned on. The amount of current passing is adjusted till the beam again balances when the current will be according to the value of the weight used. Tests having an accuracy of 1-20 of one per cent. can be quickly made and with more careful manipulation, a much higher degree of accuracy can be attained.

For purposes of graduation or standardization, the silver voltameter is used. It is one of the most accurate methods for calibrating current measuring instruments. It depends on the well-known principle that when a current of electricity flows through an electrolyte, the amount of decomposition resulting in a given time is directly proportional to the total quantity of electricity which has passed in that time. For any substance 1 coulomb will always decompose or liberate at the cathode the same fixed weight of the substance and is defined as its electro-chemical equivalent. The latest experiments agree in giving 0.001118 as the electro-chemical equivalent of silver. The specification for the electrolyte is given in schedule B. A more convenient, if not quite as accurate a method is the copper cell. The experimenter should be careful to procure pure copper sulphate and plates and the use of a chemical balance. A small quantity of sulphuric acid will improve the electrolyte. The electro-chemical equivalent of copper is 0.00237, or 1.177 grammes of copper are deposited per ampere-hour, approximately.

Another method for the measurement of current and the standardization of instruments is the fall of potential or potentiometer method. The department is now installing one of Crompton's laboratory instruments of this type, made expressly to order and suitable for reproducing and comparing standards with the highest possible degree of accuracy. Standard resistances of the following capacity are furnished with the instrument for current measurement:—

Resistance in ohms.	Maximum current in amperes.
1.	1.5
.5	3.
.1	15.
.01	150.
.005	300.

These resistances consist of a sheet or strip of metal, or a coil of wire, each provided with 4 terminals, 2 for connection to the circuit and 2 for connection to the potential leads. The resistances are made of manganin and owing to the exceeding low temperature co-efficient of the alloy, no temperature correction is necessary except for inaccuracies exceeding 1 part in 1,000 when a curve giving the temperature value of the whole range of current that the instrument is capable of carrying is supplied. The current to be measured is passed through one of these standard resistances and the fall of potential noted. If the resistance standards are properly proportioned to the instrument, the reading in amperes will be direct. Thus a standard carrying 1,500 amperes should cause a fall of 1.5 volts, each section of the instrument being equivalent to 1-10 of a volt will therefore correspond to 100 amperes. The accuracy of the apparatus for current measurement, as will be observed, is largely dependent on the accuracy with which the standard resistances are constructed.

Another method for the measurement of current by the fall of potential is that known as the "Vienna Method." A set of instruments comprising a Weston milli-voltmeter and shunt box have been procured and forms one of the most flexible, and at the same time, accurate means of current measurement. In this as in the preceding method, if the resistances are proportional to the voltmeter, the reading in amperes will be direct. The resistances in the shunt box are made of manganin alloy with practically no temperature variation and are correct to 1-5 of 1 per cent. The combination gives three full scale readings as follows:—From 0 to 1.5 amperes—from 0 to 15 amperes and from 0 to 150 amperes. Tests can be made with great rapidity and readings on each scale from a small fraction of an ampere up to the maximum can be had in the space of two or three minutes.

MEASUREMENT OF ELECTRO-MOTIVE FORCE.

PRIMARY STANDARDS.—Two standard Clark cells three Hibbard 1-volt cells and a set of six special standard multicellular electrostatic voltmeters by Lord Kelvin. The latter covers a range of from 20 to 3,200 volts and was specially constructed for the department as ultimate standards of E.M.F., great accuracy and permanency being guaranteed. During the two years since the instruments were first installed, the variation in the calibrating curves has been less than 1 part in 10,000. These instruments have the great advantage of being equally accurate on direct or alternating circuits. Being electro-static, they use no current and are unaffected by local magnetic conditions. They can be kept continuously in circuit and require no temperature correction.

The instruments are calibrated by comparison with the difference of potential between the terminals of a known resistance through which the current is being measured by means of a Kelvin standard centi-ampere balance or by the potentiometer method.

Intercomparisons with the standard E.M.F. cells will be periodically made and all variations recorded. The specification for the standard Clarke cell will be found in schedule C.

THE POTENTIMOTER. This excellent piece of laboratory apparatus and its adjuncts, though equally applicable to the measurement of current and resistance more properly comes under the head of E.M.F. standards for treatment. The fall of potential method of making measurements originated with Poggendorf, but the credit for developing the system from a crude workshop method up to what may fairly be described as a scientific instrument of no mean calibre, mainly belongs to Mr. R. E. Crompton, of London. Measurements from the lowest to the highest value may be taken by direct comparison

with the legal standard, to well within 1-10 of 1 per cent. under ordinary circumstances, whilst, by special care, a far higher degree of accuracy may be attained. The form of instrument now being furnished the department by the Messrs. Crompton, may be said to consist of 15 sections of wire connected in series, 14 of which are in the form of coils within the instrument, the 15th being stretched along a scale suitably divided; they are accurately adjusted with each other, so that with a fixed E.M.F. of 1.5 volts over the whole each section has a fall of 1-10 of a volt, the scale beneath the slide wire having 1,000 divisions each, corresponding therefore, to 1-10000 of a volt. The unknown quantity to be measured is placed in series with a galvanometer attached to the movable contacts on the slide wire and is so connected up that its E.M.F. opposes that of the main circuit of the instrument. No deflection of the galvanometer takes place when the point of balance between the opposing E.M.F.'s is obtained. The value of the comparison is then read from the scale. The instrument is calibrated by substituting for X a known value or standard—in this case a standard Clarke's cell—its temperature noted, and the contacts on the slide wire placed upon the figures corresponding with the value of the cell which would be 1.434 or 14 and 34. Resistance is added in the main circuit until there is no deflection on the galvonometer due to the fact of the E.M.F.'s in the main and galvanometer circuits being equal; the instrument is thus standardized from what afterwards becomes the X circuit and is then ready for obtaining the value of unknown E.M.F.'s. Multiples and submultiples of the ohm are used to vary the range of the instrument. They are so proportioned that their maximum carrying capacity is some definite value proportional to that of the instrument (1.5 volts) and it is entirely upon them that the range of the apparatus depends. Given proper standard resistances, the range of the instrument is practically illimitable.

Weston standard voltmeters are used as secondary standards of E.M.F., both for direct and alternating current.

One of these, for alternating current work was specially made for our laboratory and has its coils and working parts immersed in oil, thus making it absolutely "dead beat" in its operation. It is supplied with a differential scale giving readings to 1-5 volt. These voltmeters are furnished with multipliers giving ranges from 0 to 1,500 volts, and accurate to within 1-10 of 1 per cent.

MEASUREMENT OF ELECTRICAL ENERGY.

ONE STANDARD KELVIN WATT BALANCE.—This balance is intended to measure the true energy developed in an inductive alternating current circuit. It is similar in form to the Ampere Balances, but the movable coils are wound with fine wire. These coils are of low resistance and are joined up in series with a large non-inductive resistance in a potential circuit across the mains, while the fixed coils carry the whole current to be measured. Three sets of weights are supplied with the instruments, weighing respectively 1.7564 grms., 4.3910 grms. and 17.5640 grms. The constant for each set of weights with 1,000 ohms in the fine wire circuit is 2 watts, 5 watts and 20 watts per division of the scale. The constants vary directly as the resistance in the fine wire circuit. This instrument has proven to be an excellent standard having been in constant use for four years with absolutely no change in its accuracy.

Secondary Watt Standards in use by the departmental officers are those of the Weston and Hoyt types.

ACCESSORIES.

As accessories to these standards, it may be stated that two alternators are being installed and these will be operated from storage batteries thus ensuring a constant E.M.F. One of these is a 3-phase, 60-cycle machine and the other a single phase, 130 cycle machine. Both are nominally 104-volt alternators but are capable of wide ranges of variation, both in respect of voltage and frequency. Direct current measurement is made from the storage battery.

As a source of E.M.F. I have prepared 300 secondary cells giving a range of from 2 to 650 volts. Very satisfactory comparisons can be made with the absolutely steady pressure from these cells.

PHOTOMETERIC MEASUREMENT OF LIGHT.

THE BUNSEN PHOTOMETER is used throughout the Dominion by the officers of the department. This piece of apparatus is so well known that a lengthy explanation of it before this Association would be quite unnecessary. It is known as the grease spot method and consists mainly of a wooden movable frame over which a piece of white paper is fixed with a grease spot in the centre. The two sources of light to be compared shines on either side of the disc and the practical value of the light to be measured is determined by the total brightness which that light is capable of producing on the disc when compared with the total brightness which the unit candle is capable of producing on the same surface. In order that both sides of the disc may be read instantaneously a system of mirrors introduced by Rudorff is used. The sliding carriage containing this arrangement of disc and mirrors is moved along the scale until it reaches a point where the spot entirely disappears. The candle-power of the light being measured is then obtained by dividing the square of the distance of the source of light from the screen by the square of the distance of the standard candle from the screen. Notwithstanding the fact that the sperm candle is not a first-class standard, fairly accurate work can be done with it. The incandescent lamp is now more or less used as a secondary standard for the practical measurement of light, but the system is dependent on too many conditions being fulfilled to be accepted with any degree of confidence. Sir William Preece, among a number of others, considered that an incandescent lamp of a given type, coming from the same maker, present only insignificant differences among themselves with respect to luminous intensity and efficiency, and he was of opinion that a very convenient standard of this kind sufficiently exact for most purposes might be obtained. The subject of photometery and light standards is, however, a very large one and had better be reserved for treatment on some future occasion.

In conclusion, I would like to say just a word or two with reference to the accommodation afforded by the department as a standardizing laboratory. The room at present occupied in the Inland Revenue Department is altogether unsuited for the purpose. The flooring above and below is laid on iron joists, and these are supported by massive iron girders and columns. If the magnetic conditions surrounding these masses of iron were constant and unchanging, the errors due to their presence might, in a large measure, be compensated for; but unfortunately, live wires run over and along these girders, and the generating units are operated in their midst, rendering at once a condition of affairs anything but harmonious in so far as the use of delicate and sensitive instruments are concerned. Fortunately the Kelvin standards for current and E.M.F. are not affected by local magnetic conditions, but the sensitive galvanometers are very seriously affected and accurate work with such instruments is almost, if not quite an impossibility. It is hoped that the Government will, in the near future, provide more suitable accommodation for the work.

SCHEDULE A.

THE ELECTRICAL UNITS ACT.

1. This Act may be cited as *The Electrical Units Act.*

2. The units of electrical measure for Canada shall be the following:—

(*a.*) As a unit of resistance, the ohm, which is based upon the ohm equal to 10^9 units of resistance of the centimetre-gramme-second system of electro-magnetic units, and is represented by the resistance offered to an unvarying electric current by a column of mercury, at the temperature of melting ice 14·4521 grammes in mass, of a constant cross-sectional area and of the length of 106·3 centimetres.

(*b.*) As a unit of current, the ampere, which is one-tenth of the unit of current of the centimetre-gramme-second system of electro-magnetic units, and is represented sufficiently well for practical use by the unvarying current which, when passed through a solution of nitrate of silver in water, and in accordance with the specification contained in schedule one to this Act, deposits silver at the rate of 0·001118 of a gramme per second.

(*c.*) As a unit of electro-motive force, the volt, which is the electro-motive force that, steadily applied to a conductor whose resistance is one ohm, will produce a current of one ampere, and which is represented sufficiently well for practical use by $\frac{1000}{1434}$ of the electro-motive force between the poles or electrodes of the voltaic cell known as Clark's cell, at a temperature of 15° centigrade and prepared in accordance with the specification contained in schedule two to this Act.

(*d.*) As a unit of quantity, the coulomb, which is the quantity of electricity transferred by a current of one ampere in one second.

(*e.*) As a unit of capacity, the farad, which is the capacity of a condenser charged to a potential of one volt by one coulomb.

(*f.*) As a unit of work, the joule, which is equal to 10^7 units of work in the centimetre-gramme-second system, and is represented sufficiently well for practical use by the energy expended in one second by one ampere in one ohm.

(*g.*) As a unit of power, the watt, which is equal to 10^7 units of power in the centimetre-gramme-second system, and is represented sufficiently well for practical use by the work done at the rate of one joule per second.

(*h.*) As the unit of induction, the henry, which is the induction in a circuit when the electro-motive force induced in that circuit is one volt, while the inducing current varies at the rate of one ampere per second.

3. The units of electrical measure described in the next preceding section, or such standard apparatus as is necessary to produce them, shall be deposited in the Department of Inland Revenue and shall form part of the system of standards of measure and weight established by *The Weights and Measures Act.*

SCHEDULE B.

SPECIFICATIONS FOR THE SILVER VOLTAMETER.

In the following specification, the term silver voltameter means the arrangement of apparatus by means of which an electric current is passed through a solution of nitrate of silver in water. The silver voltameter measures the total electrical quantity which has passed during the time of the experiment; and by noting this time, the time-average of the current, or, if the current has been kept constant, the current itself, can be deduced.

In employing the silver voltameter to measure currents of about one ampere, the following arrangements should be adopted. The cathode on which the silver is to be deposited should take the form of a platinum bowl not less than 10 centimetres in diameter and from 4 to 5 centimetres in depth. The anode should be a plate of pure silver 30 square centimeters in area and 2 or 3 millemetres in thickness. This is supported horizontally in the liquid near the top of the solution by a platinum wire passed through holes in the plate at opposite corners. To prevent the disintegrated silver which is formed on the anode from falling on to the cathode, the anode should be wrapped round with pure filter paper, secured at the back with sealing wax.

The liquid should consist of a neutral solution of pure silver nitrate, containing about 15 parts by weight of the nitrate to 85 parts of water.

The resistance of the voltameter changes somewhat as the current passes. To prevent these changes having too great an effect on the current, some resistance besides that of the voltameter should be inserted in the circuit. The total metallic resistance of the circuit should not be less than 10 ohms.

SCHEDULE C.

SPECIFICATION FOR THE STANDARD CEARKE CELL.

The cell consists of zinc and mercury in a saturated solution of zinc sulphate and mercurous sulphate in water, prepared with mercurous sulphate in excess, and is conveniently contained in a cylindrical glass vessel.

The mercury.—To secure purity it should be first treated with acid in the usual manner, and subsequently distilled *in vacuo.*

The zinc.—Take a portion of a rod of pure re-distilled zinc, solder to one end a piece of copper wire, clean the whole with glass paper, carefully removing any loose pieces of the zinc. Just before making up the cell, dip the zinc into dilute sulphuric acid, wash with distilled water, and dry with a clean cloth or filter paper.

The zinc sulphate solution.—Prepare a saturated solution of pure ("pure re-crystallized") zinc sulphate by mixing in a flask distilled water with nearly twice its weight of crystals of pure zinc sulphate, and adding zinc oxide in the proportion of about 2 per cent by weight of the zinc sulphate crystals to neutralise any free acid. The crystals should be dissolved with the aid of gentle heat, but the temperature to which the solution is raised should not exceed 30° C. Mercurous sulphate treated as hereinafter described, should be added in the proportion of about 12 per cent by weight of the zinc sulphate crystals, and the solution filtered, while still warm, into a stock bottle. Crystals should form as it cools.

The mercurous sulphate.—Take mercurous sulphate, purchased as pure, and wash it thoroughly with cold distilled water by agitation in a bottle; drain off the water, and repeat the process at least twice. After the last washing, drain off as much of the water as possible.

Mix the washed mercurous sulphate with the zinc sulphate solution, adding sufficient crystals of zinc sulphate from the stock bottle to ensure saturation, and a small quantity of pure mercury. Shake these up well together to form a paste of the consistence of cream. Heat the paste, but not above a temperature of 30° C. Keep the paste for an hour at this temperature, agitating it from time to time; then allow it to cool, continuing to shake it occasionally while cooling. Crystals of zinc sulphate should then be distinctly visible, and should be distributed throughout the mass. If this is not the case, add more crystals from the stock bottle, and repeat the whole process. This method ensures the formation of a saturated solution of zinc and mercurous sulphates in water.

Contact is made with the mercury by means of a platinum wire about No. 22 gauge. This is protected from contact with the other materials of the cell by being sealed in a glass tube. The ends of the wire project from the ends of the tube; one end forms the terminal; the other end and a portion of the glass tube dip into the mercury

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Balancing a 3-wire Alternating Secondary System.

By L. Denis, Quebec City.

This paper has the misfortune of having been prepared under rather short notice: its subject had to be chosen so as to be easily developed, to make the paper as short as possible. In fact the main object of this paper is to open a discussion on the relative merits of the different alternating current secondary systems.

During the past seven or eight years great achievements have been wrought in long distance, high tension transmission, and probably the efforts which these have required may account for the little attention given towards improvements in secondary systems.

Poor distributing regulation is a very common and even accepted occurrence amongst central stations; and this, if not properly checked, may very likely be the cause of a retardation in the electrical progress.

In this paper it is intended to give a short description of the method employed by the Jacques Cartier Water Power Company, of Quebec, for keeping a three-wire secondary network in proper balance. Before entering into the subject of secondary distribution proper, kindly allow a short description of the whole distributing system.

As in most distribution of any size, the city is divided into several districts, fed by separate single phase primary feeders (the power distribution being quite separate from the lighting).

In each of these districts is a main bank of transformers connected to feed a three-wire distribution (108 volts on each side). These transformers are separated from one another by properly fused junction boxes in the two outside secondary wires and set midway (electrically) between transformers. The primary feeders are regulated by means of Stillwell regulators from direct pressure readings taken at different points of each of the banks and carried back to the station by pressure or pilot wires, which are strung in the form of a cable and which show the pressure across the two outside wires on a 200-volt voltmeter, which takes a current of only .006 of an ampere. The neutral wire is also carried back to the station in the same cables and arranged on a switch so that the readings on each side of the three-wire system may also be obtained on a standard voltmeter. The outlying districts are fed from independent transformers, with which we are not concerned in this paper.

Coming now to the subject proper and considering an individual consumer—it is essential to know three facts about him before any attempt is made at keeping records:

1. What side of the secondary circuit the connection is made on.
2. What transformer in the bank the connection is made on.
3. What his approximate maximum demand will be.

Knowing these for each consumer, it is quite simple to arrive at the maximum demand on each side of every transformer, and a record thereof may be kept.

The method employed by the above-named Company to ascertain these three facts is as follows: For each consumer to be connected, a form is filled out giving the name and address of consumer; from his address the transformer he will be fed from is determined and put down, and by referring to records for this transformer, the best side to put consumer on is also determined and put down. The slip thus filled out is handed to the foreman of a service connection gang, who has to go by it in running the service wires, and returns it to the office as soon as he is through. If, however, for some reason or another, he finds it impossible to follow the slip to the letter, he is instructed to make whatever alterations are necessary, so that when the slip is handed back it shows the actual manner in which the consumer has been connected.

Now, going into further details about the three points above enumerated, little need be said about the 1st, except describing the manner in which one side of the secondary system is distinguished from the other.

The three wires are strung on a four-pin cross-arm, using three consecutive pins, the same relative position being maintained all along the bank. This construction will give you at each pole the same two wires (one outside and the neutral) separated by the pole and the other two (the other outside and the neutral), with nothing between. These two sides may be designated as "a" and "b," or "1" and "2," or any other convenient symbols respectively.

It is evident that great care must be taken in running three wire taps from a main line not to have circuit "a" of your tap connected on circuit "b" of the line and circuit "b" of tap on "a" of line, as this is certain to give rise to very serious errors.

To determine the second point, maps of the different districts of the city are maintained and kept up-to-date, as far as changes on the lines are concerned. These maps show the secondary line and taps, and the exact position of transformers and junction boxes. Knowing a consumer's address, his exact location is ascertained with the help of a city directory and the transformer feeding the nearest mains determined. The transformers are distinguished from one another by numbers painted on them after they are tested. The transformers are numbered in the order they come through, irrespective of size or the bank in which they are to be inserted.

The only difficulty to be encountered in connection with this second point, happens when a new transformer is set up to reinforce the bank. When it is found from the records that a transformer in the bank is being overloaded, which really only means that the demand per unit length is becoming greater in that part of the bank, it be-

comes necessary to have the transformers at that point nearer one another, which means that another transformer has to be inserted, and possibly the existing ones moved. To get at the best position for this new transformer, what may be termed "trial records" are made out from the original connection slips belonging to the transformer or transformers to be relieved, by placing the new transformer and its junction boxes in different imaginary positions on the map, choosing the position which gives the best results on these "trial records." These "trial records," although very nearly correct, cannot be relied upon as absolutely accurate, and an inspection of the line has to be made after all changes are completed to determine exactly what customers have been changed from one transformer to the other, and of course records changed accordingly.

The third and possibly most important point may at first sight seem very hard to determine with any degree of accuracy, but if proper judgment be used in establishing certain factors for different classes of consumers dealt with, maximum demand may easily be determined.

The factors used by the Jacques Cartier Water Power Company are governed mainly by the rate under which a consumer contracts, but in some cases also by the class of consumer to be served. For ordinary meter consumers (residences and stores of moderate size), 40 per cent of the total installation is taken as a maximum demand; for the larger stores and manufacturers individual factors are assigned, which generally vary from 75 per cent. to 90 per cent. of total installation. For consumers on the flat rate, 90 per cent. of total capacity contracted for is taken. Consumers on limited capacity system are the most easily dealt with, as naturally the maximum demand contracted for must be taken as their maximum demand without introducing any factor whatsoever.

A few figures may be of interest to show a comparison between the actual maximum demand as read on distributing switchboard meters and the total maximum demand as estimated in the manner described above for the corresponding circuit.

Max. Dem. in lamps from switchboard meters.	Estimated max. demand.	Per cent. of actual on estimated.
1,840	2,206	83
3,200	4,272	75.0
1,320	1,767	75.5

As figures show that the "actual" and "estimated" bear approximately the same ratio to one another in different districts, all the more will they do so on different transformers and on the two sides of the same transformer, for the factors above referred to will actually tend to be more alike in one part of the district than in different districts. So that as far as balancing is concerned, the estimated figures may be relied upon with absolute confidence.

Another proof of at least the approximate accuracy of figures arrived at by estimate may be obtained from the fact that in spite of the very rapid growth of the plant (over 30,000 lamps of 16 C.P. having been connected in about one year), and having been guided entirely by this estimated maximum demand in all changes and additions to city distribution, not one case of burnt-out transformer from overload has occurred, and only three cases of blown fuses.

It is hoped that the contents of this short paper will go towards removing some of the objections to an alternating three-wire secondary system.

Conversion from Constant Alternating Potential to Constant Alternating Current.

By R. B. Owens, Montreal.

For purposes of economic station operation as well as economy of copper in distribution, particularly in connection with water power developments, the use of large generator units of the alternating current type can be taken as standard practice.

Assuming then an alternating current supply at constant potential, the several principal methods for its conversion for power interior illumination and street lighting may be recalled.

For power, both the induction and synchronous motor under proper operating conditions are highly satisfactory. For interior lighting excepting of large areas, the use of constant potential transformers and incandescent lamps is practically universal.

For street lighting however the case is different, there being little uniformity either as to apparatus employed or results obtained.

The following are the methods principally in use:

1. Induction or synchronous motors driving direct constant current open or closed coil, dynamos of different current capacities and open or enclosed direct current arcs, the latter type growing in favor.

2. A coil of constant or variable inductance in series with a circuit of enclosed alternating arcs, current being supplied from constant potential mains.

3. Constant alternating current transformers, usually of the repulsion coil type and enclosed alternating arcs.

Street lighting by constant potential alternating arcs and by incandescent lamps while occasionally resorted to under special conditions, need not here I think be considered, the first because of low power factor, inconvenience of central control and low ratio of energy in arc to energy supplied to lamp terminals, and the second because of comparatively low candle power—watt efficiency.

In any system of arc lighting from an alternating current source considerations of efficiency, power factor and constancy of current in lamp are of primary importance.

With regard to the first method mentioned, namely, motor generator sets and direct current arcs, its chief drawback is low efficiency, little if any better than 75 per cent. under favorable conditions.

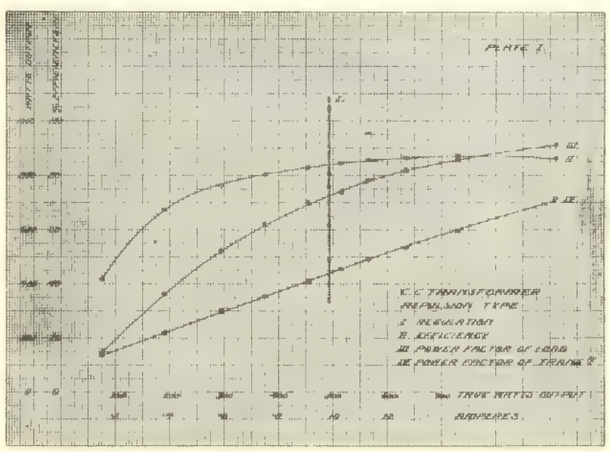
As against this, however, must be counted the advantage it affords in the use of enclosed direct current series arcs, both photometric and power measurements showing their superiority to the alternating type. The line power factor also in general is good, being from 90 to nearly 100 per cent. at full load depending on whether induction or synchronous motors are used.

The regulation of a modern direct constant current arc generator is likewise satisfactory.

In the second method, if a large inductance is used, the power factor is poor and the regulation good, and conversely with a small inductance the power factor is good and the regulation poor.

In practice it is found that a comparatively large inductance must be used to take care of possible short circuits on line which in general means poor power factor. The efficiency however is good at full load.

The third method, constant current transformers of the repulsion coil type and enclosed alternating arcs has come



rapidly into prominence in the past two years, some thirty thousand series arcs being operated in this way at the present time.

The special features of merits of this system seem to be high efficiency, close regulation, small spacerequired as compared with motor generator sets, and the insulation of the arc circuits from the generator. The power factor is, however, poor, about 80 per cent. under favorable conditions at 60 cycles and 70 per cent. at 125 cycles, and decreases rapidly with load.

For purposes of comparison, I have shown in plate I the results of a test of a small constant current transformer—one k.w. 1,000 volts, I ampere, of the repulsion coil type, not that the performance of so small a unit is as good as can be obtained in larger sizes, but, as all sizes possess certain characteristics in common, the results shown will serve our present purpose.

Curve 1, plate 1 is the regulatian curve and shows that with proper adjustment the regulation may be perfect Curve 2, plate 1 is the efficiency curve, and shows that while the maximum efficiency is not high in this particular size, nevertheless a good efficiency is maintained throughout a considerable range. Curve 3, plate 1 is the power factor of load, and curve 4, plate 1 is the power factor of the transformer and load. It will be noted that the power factor of the combination is uniformly lower than the load power factor which is characteristic of all sizes within the limits of commercial practice.

The particular object of the present paper is to emphasize another method of constant potential constant current transformation which, while known for some time, has not apparently received the attention it deserves.

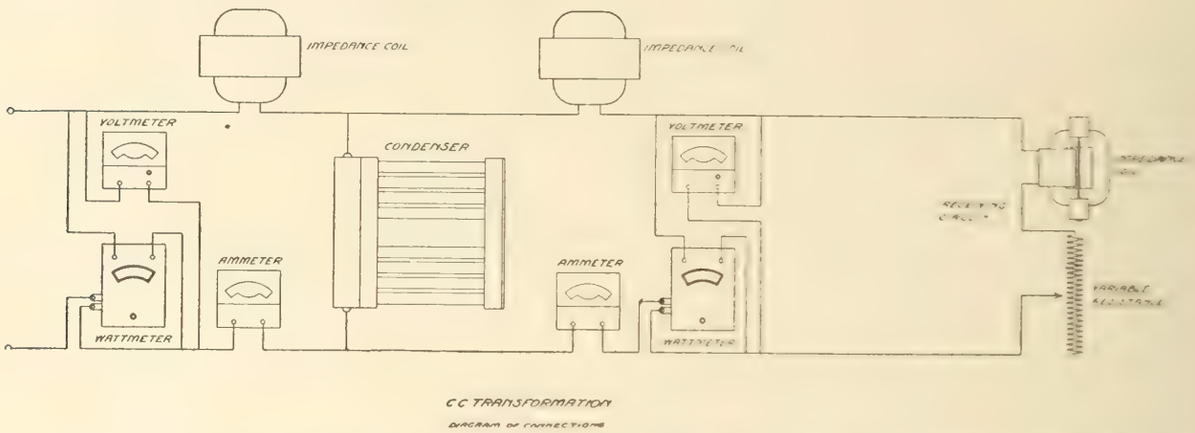
I refer to the combination of impedence coils and condenser shown in plate 2, due originally, I think, to Le Blanc, and treated mathematically by Steinmetz and others.

From the theoretical consideration it can be shown that when a constant potential is applied to two equal mag

netic reactances in series with a variable non-inductive receiver circuit, the receiver circuit and one reactance being shunted by a condenser whose capacity reactance numerically equals either magnetic reactance the current in the receiver circuits will remain constant and be independent of the receiver circuit resistance.

To test such an arrangement practically, two impedence coils, the dimensions and data of which are shown in plate 3 were constructed, their reactances being variable by the insertion of strips of rubber under their keepers, and connected in series with a smaller coil of constant reactance and a variable non-inductive receiver circuit. A

PLATE II



CC TRANSFORMATION
DIAGRAM OF CONNECTIONS

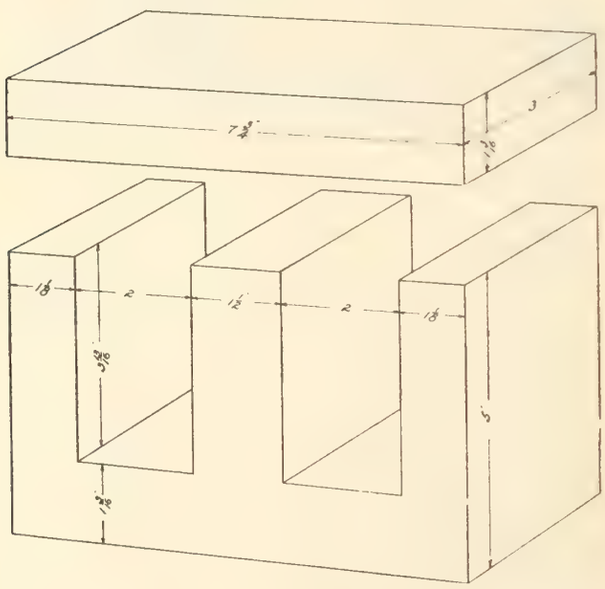
28 M.F. Condenser shunted the receiver circuits and the two impedence coils. The reactance of the two coils in the receiver circuit was made as nearly as possible equal to the reactance of the remaining impedence coil and also of the condenser.

500 volts at 55 cycles was then applied to the main circuit and the efficiency and the power factor of the combination noted as well as the current in the receiver circuit.

Plate 2 plainly shows the arrangement of apparatus and testing instruments.

In plate 3 are given the results.

PLATE III



IMPEDANCE COIL
WOUND WITH 490 TURNS
NO 12 B&S WIRE
RESISTANCE .38 OHMS
16 MIL IRON

As the power factor of the receiving circuits is varied from a small value to something over 80 per cent., it will be noted that the power factor of the main circuit remains throughout practically unity.

The efficiency is nearly constant through a wide range although not high in this particular case, due to the design of the impedence coils.

The regulation curve shows that the current in the receiving circuit varied only some six per cent. between half and full load, a sufficiently satisfactory result. Perfect regulation, however, can be obtained with better proportioned apparatus.

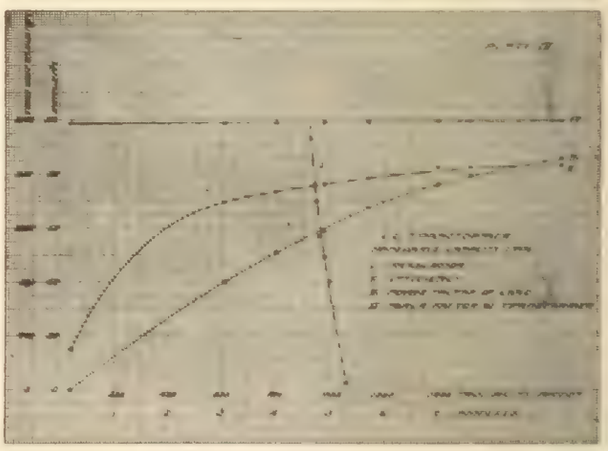
On the whole the results though not as good in some particulars as can evidently be obtained after a full development of the system are nevertheless, I think, of considerable interest to central station managers, as they clearly point to a method of constant potential—constant-current transformation possessing the characteristics of high efficiency, unity power factor, close regulation, absence of moving parts and requiring a comparatively small floor space.

It is to be hoped that some of our larger makers will devote further attention to the method.

The Influence of the Load Factor on the Design and Operation of a Lighting and Power System.

By J. R. Roberts[illegible], Montreal.

The load factor of the station is usually defined as the ratio between the average load carried by the station for the twenty-four hours and the maximum demand at the hour of the peak load. It is only within the last few years that the managers and engineers of most of our lighting companies have come to realize that the low load factor that was considered satisfactory a few years ago, and in a measure a sort of inherent inefficiency inseparable from the business, cannot be any longer regarded in this comfortable light, and that such an explanation does not in any way reconcile their customers to paying heavy bills for lighting service or make more satisfactory the receipt of small profits by the shareholders, and that in short, some means must be found whereby this factor can be increased, so increasing the output of the station



and its revenue without appreciably increasing the investment and fixed charges.

It is unnecessary to point out to this association composed largely of managers and engineers of lighting plants, that it cannot be very economical to invest a large amount of capital in plant and then permit that plant to remain practically idle for [illegible] per cent. of the day; and this is what almost all lighting plants at present are doing. In Figs. 1 and 2 we have what was considered a very fair load curve for the twenty-four hours for a large lighting station. Fig 1 shows the light summer load and Fig 2 the winter load. On these curves is marked the average load for the twenty-four hours. This is in Fig. 1 37 per cent., and in Fig. 2, 52 per cent. of the maximum load, averaging outside of peak hours about [illegible] per cent. of the maximum demand in summer and about [illegible] per cent. in winter.

This means that of the plant installed, 70 per cent. stands practically idle for eighteen hours of the day, and in the other six hours the plant must earn enough money to pay all operating and maintenance expenses and also the fixed charges on the whole plant which remain practically the same whether the machinery is in operation or not. The fact must also be taken into account that as shown by these curves the greater part of the load at other than peak hours is composed of transformer magnetizing current which returns no revenue to the station, and that the operating charges during this period must be added to the amount chargeable against the earnings of the plant during the six hours of paying load. If a plant is to pay a dividend under operating conditions such as these, the charge for current must be enormously high; this precludes the possibility of the electric light being made popular, and

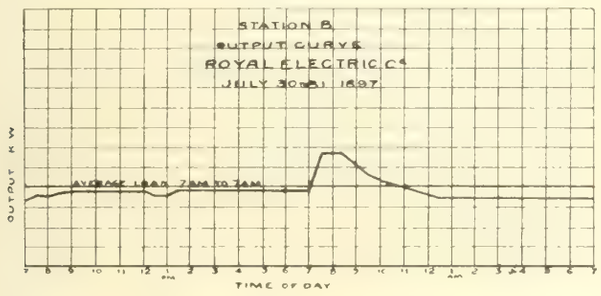


FIG. 1

confines its use to those to whom the increased price is less of an object than the increased inconvenience. With a limited patronage such as this the business cannot grow, as in every community the great majority of the people are of the class to whom the necessary increase in the price of electric light over other means of illumination is a consideration, and with whom as a rule price determines what system of lighting is used.

In selling power for the working day from seven in the morning till six at night it soon became evident that in countries as far north as Canada the hours of lighting overlapped very considerably the hours during which power was being sold. With a peak load occurring between the hours of five and six o'clock in the winter it became apparent that if the day load was to be handled economically arrangements must be made whereby this load would be off the lines before the heavy lighting load came on. To secure this end it was necessary in making contracts for power to stipulate that during the winter months power was not to be used between the hours of four and seven p.m., in most cases. A proposition of this kind is not usually met by the proprietor of a manufacturing establishment with any great cordiality, the very idea that his business could be stopped for two hours per day during six months of the year being preposterous. However on consideration the proposition is not so disadvantageous to the proprietor as at first glance it appears. When it is taken into consideration that the production of a factory is very materially reduced when working with artificial light, that the quality of the work suffers, and that the percentage of spoiled material rises decidedly, the proposition does not look quite so one sided. Add to this the fact that a stoppage of two hours out of ten per day does not as a rule lower the production except on automatic machinery more than eight or ten per cent., and that if it is absolutely necessary that the machinery be in operation more than eight hours per day

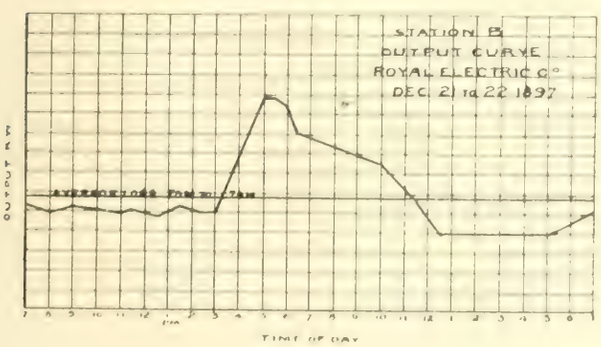


FIG. 2

it is possible by starting before seven in the morning and reducing the noon hour slightly to make the week's run aggregate 60 hours, an average of ten hours per day. If this is done a very decided decrease can be made in the rates for power, and the matter if properly presented, is reasonably certain of careful if not favorable consideration. If the whole factory cannot be stopped at four o'clock as sometimes happens, it is almost invariably the case that the greater part of the machinery can and in this case the low rate for power would apply to the part the use of which was discontinued at four o'clock, a premium being paid for the use of that part which must be used during lighting hours. For service of this class it is very evident a very low charge can be made, as with water power plants there is practically no increase in the cost of production, and in steam plants the cost of the power is little more than the cost of the coal and other operating supplies.

The number of users of power under these limited service contracts is steadily increasing and it is safe to predict that it will not be many years before the great majority of the large factories, especially in cities where current is supplied from water power plants, will shut their doors before dark and the working day will be a day in reality and will not include also a part of the night.

The system of charging for power service is a matter which has a direct and powerful effect upon the extension of this branch of the business and consequently upon the improvement of the load factor, and therefore should be the subject of careful consideration on the part of the supply company.

Of the different bases for contract rates and of methods of arriving at the proper amount of power chargeable there are almost as many as there are customers. Some companies pin their faith to the flat rate per horse power under all conditions, the better informed of this class taking into account in making the rate, the nature of the business, and the probable consumption of energy. Others use nothing but the straight meter rate, arguing in defence of it that because the customer pays for the power he uses, and for all that he uses, he is therefore paying all that he should. Others again confine themselves to no particular method quoting to each customer a rate based upon the actual conditions of the customer's business, in such a way as to ensure a proper return for the service supplied. This may take the form of any of the above methods or it may be a combination of them. The latter method which is the fairest to both buyer and seller is coming to be the usual system adopted by managers

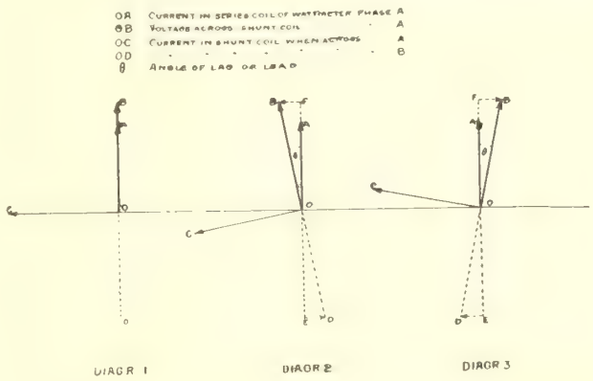


FIG. 3

who decline to make their good customers pay for the shortcomings of their bad ones. In practically all manufacturing plants there is a large fluctuation in the use of power, both from minute to minute and from hour to hour during the day and from month to month during the year. Every business has its slack seasons and if these should occur in the middle of the summer when the lighting revenue is very low it is manifestly unfair that customers to whom power has been supplied all through the season in which light is at a premium and power valuable should be permitted to cut off their demand for power to almost nothing and leave this power on the hands of the supply company at a season when it is not marketable. This applies in a lesser degree to fluctuations in demand throughout the day. There are many cases in which heavy machinery is used for perhaps two or three hours per day and in order to supply this power transformers and connections of large size must be installed while the average power supplied for the day would not perhaps amount to one-half the capacity installed. In cases such as this it is not equitable to charge the customer a straight meter rate unless this rate is very high as the revenue derived would not pay a fair average on the capacity demanded from the supply company, which capacity must be held at the disposal of the customer at all times and consequently cannot be sold to any one else. It is better in such cases to charge a fixed rate per horse power on the maximum demand as ascertained by test and to this add a meter rate per horse power hour for the actual consumption. In this way the supply company is protected against non use by the customer, as in any case the fixed rate must be paid, and it is to the customer's interest to see that the maximum load is made as low as possible. Where the nature of the business carried on by the prospective customer is well known a straight meter rate can be made satisfactorily by inserting in the contract a stipulation that the revenue must not in any case be less than a fixed sum per month,

thus protecting the supply company against loss of revenue, and with a previous knowledge of the probable maximum demand a meter rate can be determined which will ensure a proper return for the service supplied.

One of the most serious obstacles to the development of the two rate system of charging for power has been the lack of a satisfactory two rate meter. A number of meters of this type have been designed but none of them have come into use sufficiently to permit of any conclusions being drawn from their operation. These meters are of three general types. In one the meter runs at normal speed during the period in which power is sold at a low rate and it is then speeded up during the hours of peak load, the difference in speed being adjusted in accordance with the rates for power during the two periods. Another type of meter runs at normal speed during the hours of peak load and is then slowed down during the low charge period, the ratio between the speeds being determined as above. The third type of meter is one which records the power used during the two periods on two distinct dials. This latter system is the most satisfactory from both the customer's and the supply company's point of view as the amount of power used during each period is registered and charges can be adjusted as required. It has the advantage too that the customer can understand it and consequently is more likely to be satisfied with his bills. In almost all of these meters the recording mechanism is controlled by a self winding clock mechanism which at a predetermined time cuts in resistance in series with the shunt winding of the wattmeter or in some other way slows it down and at the end of the period cuts the resistance out again. With the two dial system the recording train of the meter is connected to each dial in turn at the proper time. The limit for these meters in the past is probably accountable for their very slow development but as the necessity of improving the load factor becomes more pressing meters of this type will be more in demand and there is little doubt that satisfactory instruments will be forthcoming.

In a considerable number of cases customers will refuse to have anything to do with meters, either because they doubt their accuracy, or as is more frequently the case, because they wish to know at the beginning of the year precisely what they will be required to pay for power so that they may be able to estimate on their probable expenses. In such cases the only way to arrive at a basis on which to charge is to make careful tests of the maximum, minimum and average demand for power and on a basis of the maximum quote a rate per horse power, the amount of which is based upon the closeness with which the average approaches the maximum. In some cases it may be advisable to quote two rates, one upon the fixed part of the load, motor and shafting, and another upon the variable part. This would be more favorable to those who have a considerable amount of machinery which is in operation during only a part of the day, or during only certain seasons as the lower rate permits it to stand idle with less loss to the customer. In cases where a flat

TRUE WATTS FROM WESTON W	AMPERES	VOLTS	APPARENT WATTS	SECONDS PER REV OF DISC METER Y	SECONDS PER REV OF DISC METER X	POWER FACTOR FROM INTEGRATING METERS	POWER FACTOR FROM VOLT-AMPERES & WATTS
340000	275	2040	356000	3.7	1.36	.938	.969
328000	265	2060	346000	3.68	1.35	.940	.964
328000	270	2000	340000	3.80	1.40	.938	.976
316000	280	2040	330000	3.72	1.37	.936	.971
332000	260	2080	336000	3.64	1.34	.935	.991
					AVERAGE	.937	.974
			EXCITING CURRENT INCREASED 80%				
340000	285	2120	360000	4.4	1.30	.938	.994
			EXCITING CURRENT NORMAL				
328000	265	2040	540000	3.64	1.36	.936	.975

FIG. 4

rate is required and the opinions of the supply company and the customer differ radically as to the amount of power required a compromise can usually be effected by quoting a rate based upon the amount estimated by the customer with the stipulation that if the power required as determined by test is in excess of this amount the additional power will be paid for at the same rate, that is at the rate determined by dividing the contract price by the contract amount of power. By this method the customer is protected against the possibility of mistakes on the part of the supply company and the company is protected against the possibility of the power required being greater than was anticipated.

You will notice that in almost all cases it is recommended that the rate be based upon the maximum load demanded and not upon the average. This may at first sight appear unfair to the customer but there are good reasons for the choice. From the supply company's point of view variable loads are not desirable as they are destructive of good regulation. Any rate therefore based upon the maximum puts a penalty upon poor apparatus and a premium upon good to such an extent that customers demand from manufacturers that the machinery must keep within fixed limits of power consumption, thus benefitting the customer through his reduced bill and the supply company through the improved regulation. In Montreal this policy has materially improved the conditions of load of a great many customers more particularly those to whom power is supplied for elevator service. Passenger elevators that used to require thirty horse power to start now manage to start on fifteen to twenty and there is no noticeable diminution in their speed or service.. Freight elevators that used to demand seven horse power to start under load are now started on five, and factories that used to find it convenient to operate all their heavy machinery at once, now find it economical

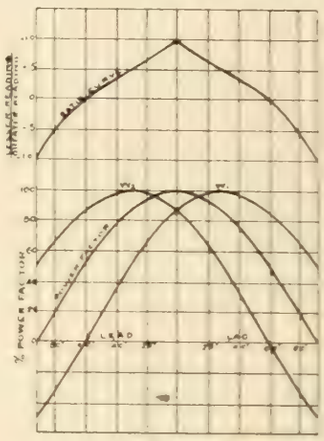


FIG. 5

to distribute the use of it throughout the day so reducing their maximum demand and making their load much more regular.

In re-arranging and re-building a plant with a view of operating a combined light and power service from the same generators and circuits, one of the first questions to be decided is the frequency. In former days when the lighting service was everything, a frequency of about 16,000 alternations per minute was most common, and for the purpose was satisfactory. For exclusively power work on the other hand, the frequency most favored was in the neighborhood of three thousand or less. At this latter figure the flickering of incandescent lamps is decidedly disagreeable and the operation of alternating arc lamps is almost impossible. At the higher frequency the operation of motors is difficult, that is in large numbers and sizes as the inductive effects are great and the power factor consequently low. The result of this is a compromise. A frequency of about 7200 or 8000 is sufficiently high to permit of the satisfactory operation of incandescent and arc lamps without noticeable flickering and sufficiently low to permit of the operation of induction motors with a power factor reasonably high and a speed reasonably low. This frequency too is about the upper limit at which rotary converters can be operated satisfactorily, so that taking into account all the branches of service, the best frequency for a combined lighting and power plant would seem to be in the neighborhood of 8,000 alternations per minute.

The frequency being decided there remains the question as to whether the generators with the transmission and distributing system shall be two phase, three phase, or some combination of the two. For a system such as is under consideration it is now pretty generally conceded that the generating plant should be two phase as with this system the unbalancing effect of lighting on single phases has less effect on the regulation that it has on a three phase generator under the same conditions. In cases where the power has to be transmitted over a considerable distance on account of the economy in copper it is generally better to transform to three phase in stepping up to the high line voltage, and at the receiving end in stepping down transform back to two phase. In practically all cases where the lighting forms any considerable proportion of the load distribution at two phase is preferable to three phase from the regulation point of view Three wire two phase systems, though somewhat more economical of copper than four wire systems, are not generally so satisfactory in operation on account of the higher voltage to which all appatatus connected to the lines is subjected together with the increased probability of trouble from wires coming in contact during storms and burning down The immunity from trouble on the lines when operating a four wire system is usually considered to more than offset the increased economy. With the distribution two phase there is no trouble in connecting three phase motors when desired as the regular motor transformers can be used, the only alteration necessary being the bringing out of a lead from the middle point of one coil. This is in almost all transformers a matter involving very little work as the secondary coils are generally wound in two

halves connected together inside the transformer and it is only necessary to connect the third lead to this point and bring it out through the case. With transformers connected on the Scott system it is evident that the vertical component of the triangle of forces will be 100 instead of approximately 87 per cent. of the secondary voltage of the other transformer, thus making the triangle of voltage isosceles, two of the sides having a higher voltage than the third. This difference in voltage on a 500 volt motor amounts to about 60 volts. The effect of this unbalancing is to throw more work on two phases of the motor than on the third and while this must evidently overwork these two coils if the motor is run at full load experience shows that any of the standard motors will operate under these conditions without undue heating. Of course if the motor is of large size it would be advisable to have the ratio of the transformers such that a true three phase current would be produced.

We come now to a consideration of the type of motor as an element affecting the improvement of the load factor. On this point there is still considerable difference of opinion especially when large units are under consideration though it is pretty generally conceded that for small motors the only type that can be considered is the induction motor. Its simplicity, the ease with which it can be started and stopped and its comparative freedom from the annoying troubles that beset its rivals make it an ideal machine to put into the hands of a customer. There is practically nothing to do except to see that the bearings are properly oiled and even this necessitates in many cases almost no attention as these motors sometimes run for a month without even requiring oil. Dust and dirt have very little effect providing the oil in the bearings is

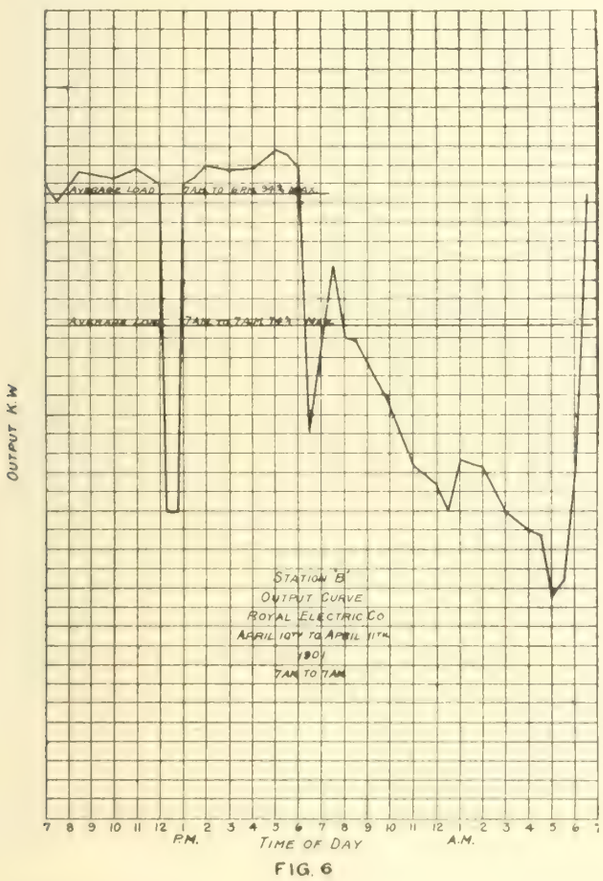


FIG. 6

changed frequently, the motor can be mounted on the wall or ceiling almost as easily as on the floor and no extra wiring is necessary if the starting devices have to be placed some distance from the motor. Heavy loads have not the same power to injure it as with other motors as if overloaded too much it merely stops and load must be removed before it will start again. As the motor may remain connected to the mains for several minutes without heating sufficiently to injure it there is no great danger in this proceeding though it is not well to make a practice of doing it. Such a thing as a burned out motor of this type is almost unknown. I cannot recall a single instance where the trouble was due to heating of the conductors unaccompanied by some other predisposing cause. It is true that with rotors of the wound type shortcircuits and grounds sometimes occur though rarely, and these can generally be traced to some defect in manufacture. With rotors of the squirrel cage type the connection of the bars to the end rings sometimes gives trouble but this is likewise generally due to some mechanical defect and motors which have operated for some time without trouble can generally be depended upon to continue to do so indefinitely. The simplicity of the starting devices and their immunity from trouble add much to the reliability of the machine especially when in the hands of inexperienced operators as is usually the case. Induction motors operating continuously for three or four years without a case of trouble are not unusual and this when in the hands of operators who probably never saw a motor before their's was installed.

Even in large units the induction motor has advantages which cannot be gainsaid, both from the point of view of the supply company and of the customer. The principal disadvantage under which it labors is the fact that its power factor is inherently comparatively low. That is that under full load or a little overload the power factor rarely exceeds 94 and few manufacturers will guarantee that figure. The synchronous motor on the other hand can readily be operated at a power factor of unity. If the motor load is of considerable magnitude this makes a very material difference to the operating station as the effect of a large amount of load even with a power factor as high as 94 is to increase the field current of the generators very decidedly. If they are of modern construction and have good regulation on low power factor loads they may be able to deliver full load current without exceeding the limits of field current, but even in this case the output of the station is lowered as the power is generally sold on a basis of true energy and not of volt-amperes. To offset as far as possible this inherent disadvantage these motors should be operated at very high load, that is high compared with what other types of motor should be operated at. If the load is comparatively steady it should be so arranged as to be just about full load for the motor, and if variable it should not be if possible allowed to drop below half load. If the periods of variation are short the motor as a rule will not suffer if the load rises to 50 or 60 per cent. overload. If under these conditions the load as measured by integrating wattmeter for the day does not exceed the capacity of the motor as a rule it will sustain no injury.

The fact that these motors do not run synchronously with the generators is a great advantage to the station in times of trouble on the lines. The only effect that heavy short circuits on the lines have on these motors is to cause them to slow down and on sudden removal of the short circuit the extra power required to accelerate their speed and bring it back to normal prevents the too rapid rise of voltage caused by the falling off in load with the valves or gates wide open, which rises are a fruitful cause of increase in the lamp renewal account. An induction motor also acts as a sort of regulator on the lines, by absorbing more power from the phase with the high voltage thus tending to lower it to equality with the others. Changes of load on induction motors have also less effect on the regulation of the system than they would have with a synchronous motor since the lowering of the load lowers the power factor thus reacting on the generator field and preventing somewhat the rise of voltage which accompanies a reduction of load. A great drawback from a lighting point of view to the use of induction motors lies in the fact that to start they require anywhere from one hundred to two hundred per cent. of full load current. This may be overcome by equipping the machine with a starting motor to get it up to speed before throwing it on the mains but this adds to the complication of the machine so greatly that it has seldom been done, although it should be more generally insisted upon. Where the motor is used to operate direct current generators the trouble may be overcome by starting the motor from the direct current side and throwing it on to the mains when at full speed.

The synchronous motor while possessing a great many advantages has also some points to which objection can be taken. The attendant can by varying the exciting current alter the voltage of the lines to such an extent as to seriously interfere with the regulation, especially if the motor be of large capacity as is often the case. Again any violent disturbance on the line is likely to pull a heavily loaded synchronous motor out of step and with motors of low self induction such as are necessary this makes a particularly vicious short circuit. If there is any large amount of load driven by motors of this type the effect of a heavy short circuit would be to pull them all out of step thus holding down the voltage. The removal of the short circuit together with this large amount of load at the same time would permit the voltage of the generators to rise very considerably and would usually be accompanied by disastrous effects on any lamps that might be burning on the circuits. In the case of large mills or other customers to whom continuity of service means much, this disadvantage should be carefully considered as the starting of a large number of synchronous motors occupies considerable time and the loss caused by the delay is sometimes worthy of consideration, not to speak of the fact that goods in process of manufacture are sometimes spoiled by the delay.

The principal advantage of the synchronous motor lies in the fact that its power factor is under the control of the operator, who, by raising or lowering the exciting current can make the current leading or lagging at will, and by properly adjusting it can operate the motor with a power factor of unity. The fact that by over exciting synchronous motors lagging currents due to induction motors or arc lamps can be compensated for is of the utmost importance. If these motors are so placed that

they are under the control of the station staff, they become valuable means of increasing the output of the station. In plants where there are motor driven arc machines or other machinery which under ordinary conditions is not in use during the day, it is advisable to have the motors of the synchronous type, as in this case they be operated all day as condensers supplying to the line the leading current necessary to balance the lagging component due to the inductive load. Properly designed motors operating in this way cause no trouble from pumping, even when over excited, till the armature current is at full load value. These motors, after being used as condensers all day, are operated at night to drive their regular load, as at that time the day load is off and the demand for leading current is not so pressing. In this way the machines do double duty.

In placing synchronous motors on customers' premises beyond the control of the station, it is advisable to install some sort of power factor indicator as otherwise an inexperienced or careless operator will rarely have the exciting current at proper value. When it is considered that a reduction in the power factor from unity to 99 per cent. involves an increase of the wattless current to about 14 per cent. of the motor current, it can be understood how important it is that the power factor be kept up. As the exciting current varies for different loads and voltages it is almost impossible in cases where the load is variable to keep the power factor unity, unless the drop in the line exactly balances the regulation of the motor, in which case no adjustment of the field current is necessary for changes in load.

There have recently been several types of power factor indicator devised, but the simplest for two phase systems is an induction wattmeter with its series coil connected in one phase and its shunt coil across the other phase, or across a transformer if it is necessary to reduce the voltage. When connected in this way the meter will run in one direction if the current is lagging and in the other direction if the current is leading, remaining stationary if the power factor is unity. If the meter is properly marked, it is only necessary for the operator to regulate his exciting current as indicated by the disc of the meter. In this way the station can protect itself against the possibility of the regulation being taken out of the hands of the switchboard attendant.

A short explanation of the action of this device may not be out of place for the benefit of those to whom it is not familiar. In an induction wattmeter there are two coils, the series and the shunt, the series having very low and the shunt very high inductance. As a consequence, the current in the shunt coil lags practically 90 degrees behind the voltage, and if the power factor of the system is unity the shunt current lags 90 degrees behind the series current. If now the voltage instead of being derived from the same circuit be derived from the opposite phase, the voltage impressed on the shunt will be 90 degrees displaced from the current in the series, positively or negatively, depending on the direction of rotation of the phases. The current in the shunt will therefore be displaced either 180 degrees from the current in the series or it will coincide with it; in either case there being no torque produced the meter stands still. (See Fig. 3, Diagram 1.) If now the current in the system be made leading, it is evident that the displacement of the current in the shunt with respect to the current in the series coil will be the sum of the angle of lead and 180 degrees, of which 90 degrees may be positive or negative. Suppose the lead to be ten degrees. As the angle 90 degrees may be either positive or negative, the total displacement will be either 10 plus 90 plus 90 equals 190 degrees, or 10 plus 90 minus 90 equals 10 degrees giving a torque proportional to the horizontal component BF in Diagram 2, Fig. 3. Similarly for a lagging current the displacement would be 170, or minus 10 degrees, giving a torque component opposite in direction, though of the same magnitude as in the former case. (See Diagram 3, Fig. 2.)

One of the most important points in selling power is its proper measurement and in order to ensure the proper revenue from each customer the metering devices must be constantly looked after and checked, as otherwise inaccuracies creep in and as these are usually against the supply company the revenue may be seriously impaired.

For metering two phase systems as a rule two wattmeters are used, one being connected in each phase and as the two phases are electrically independent, the readings of the wattmeters when added together give the total power in the circuit. In most lighting systems where the circuits have been carefully laid out the motors will be so nearly balanced that the readings of the meters will be sensibly equal, in which case one meter will answer, the registration being multiplied by two to get the total. It is possible to use amperemeters on motors of this type as the voltage is sensibly constant and if the voltamperes as determined from the meter register and the voltage be corrected by a power factor determined by test the energy may be determined with a fair degree of accuracy.

The energy used by a three phase motor is measured as a rule in one of two ways, one meter and a star box, or two meters. The first method is applicable only to motors that are balanced, as any appreciable difference in the voltage of the phases introduces a considerable error. However, with non-inductive wattmeters and a balanced system this method is very convenient and has the advantage of requiring only one meter. The star box consists of a non-inductive resistance twice as great as the resistance of the shunt coil of the wattmeter. One terminal of the shunt of the meter is connected to the leg in which the series coil is inserted and the other end to the middle point of the star resistance, the two ends of which are connected to the other two legs of the three phase circuit. In this case the total energy in the circuit is three times the reading of the wattmeter.

For unbalanced circuits, which are most common, the two wattmeter method must be used. In this system one wattmeter is connected in each of two legs of the circuit, one end of the shunt coil of each being connected to the same point as the series, and the other ends connected to the third leg of the circuit. The total energy in the circuit will then be the sum of the meter readings, that is, the algebraic sum, as one reading may be negative. The indications of the meters will in most cases not be alike, as this is only the case if the power factor is unity and the circuit is balanced, under other conditions the indication of one meter may be anything from 0 to 100 per cent. of the other. In connecting the meters care must be taken to see that they run in the proper direction to make the sum of the registrations the total energy of the circuit. Having connected the meters temporarily, note the direction in which the meters run with light

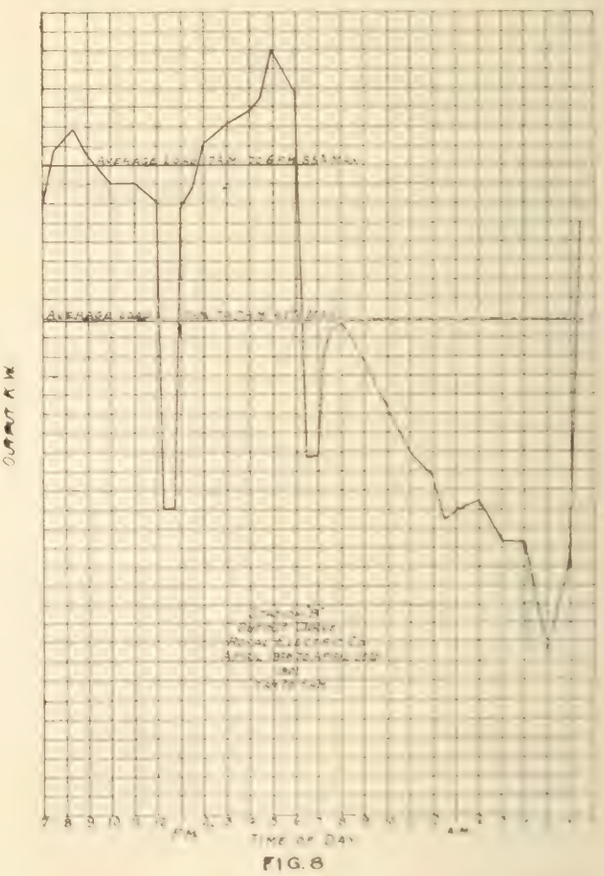


FIG. 8

load on the circuit. If they are both running forwards increase the load on the circuit considerably. If now both meters are still running forward and have increased their speed the connection is correct, while if one meter continues to run forward at increased speed while the other has slowed down or reversed, it indicates that the meter whose rate decreased is connected backwards and should be reversed.

In testing motors, especially those of large size, considerable care must be exercised in order to make the results of the test show accurately the amount of power used. As the load is usually somewhat variable, it is almost impossible to read ordinary indicating instruments with any degree of accuracy. Errors of five and ten per cent. are common even when observers are experienced, and as a result tests made in this way are always open to doubt. To overcome this difficulty as far as possible integrating meters are now largely used to determine the energy delivered to motors of this type. The meter being connected into the circuit in the same manner as an indicating wattmeter, the speed of the moving disc is measured for a period of twenty to thirty seconds and from this and the constant of the meter the watts are deduced. The integrating meter can be checked on perfectly steady load when convenient and the proper correction made. As wattmeters can now be procured which

variation of rate on loads having different power factors is practically zero, this need not introduce any appreciable error. Complete tests can be much more satisfactorily made in this way than by a comparison of the voltamperes with the true watts. To determine the load and power factor of a two phase motor, proceed as follows: Connect two wattmeters in series in one phase of the circuit. Connect the shunt coil of one across the same phase and the shunt coil of the other across the second phase. With load on the circuit determine the watts indicated by each meter, calling the indication of the meter whose series coil is in phase A, and whose shunt is across A_1-X, and the indication of the meter whose series coil is in A and shunt across B_1-Y. Then the energy in phase A is indicated by X, and the power factor of phase A is found as follows:

$$\text{P. F.} = \frac{Y}{\sqrt{K^2 Y^2 + X^2}} \text{ where } K = \frac{\text{Voltage of A}}{\text{Voltage of B}}$$

For indications on meter, X are proportional to voltamperes multiplied by the cosine of the angle of lag, and the indication on wattmeter Y is proportional to the cosine of the angle of lag plus or minus 90 degrees, or equals voltamperes multiplied by the sine of the angle of lag.

Let V_1 be voltage of phase A
Let V_2 be voltage of phase B
Let I_1 be current of phase A
Let ϕ be angle of lag
Then $X = V_1 I_1 \cos \phi$
Then $Y = V_2 I_1 \cos \phi$
Then $\frac{V_1}{V_2} = K$
Then $X = K V_2 I_1 \cos \phi$
Then $Y = V_2 I_1 \sin \phi$
Then $\frac{X}{Y} = \frac{K \cos \phi}{\sin \phi}$
Then $\frac{X_2}{Y_2} = \frac{K_2 \cos^2 \phi}{I \cos^2 \phi}$
Then $\cos \phi = \frac{X_2}{K_2 Y_2 + X_2}$
Then $\cos \phi = \frac{X}{\sqrt{K^2 Y^2 + X^2}}$

In case the system is balanced.
$K = I$

$$\cos \phi = \text{Power Factor} = \frac{X}{\sqrt{Y^2 + X^2}}$$

As in most cases it is much more accurate to measure seconds per revolution than revolutions per second, and as a rule the two meters used are of the same capacity and have the same constant, it is sufficient to compare the seconds per revolution instead of the watts, and as seconds per revolution is the reciprocal of revolutions per second the formula will have to be changed. Instead of writing

$$\cos \phi = \frac{X}{\sqrt{K^2 Y^2 + X^2}}$$ we substitute $\cos \phi = \frac{Y}{\sqrt{K^2 Y^2 + X^2}}$ or for Balaic $\frac{Y}{\sqrt{Y^2 + X^2}}$

in which X and Y are seconds per revolution of the meters respectively whose watt readings were X and Y.

As an example of the accuracy with which tests can be made by this method when compared with the older volt ampere method, I would draw your attention to the results given in Fig. 4. You will note that the power factor as determined by integrating wattmeter varied only among the five readings by one half of one per cent., while the power factor from the voltamperes and watts by Weston wattmeter varied 2.7 per cent. I might add that the watts from indicated wattmeter is the average of readings of two Weston wattmeters which agreed with each other and were read by two observers. The change in the power factor introduced by altering the exciting current of a synchronous motor was instantly detected by this means while the voltampere method failed to show it. When the conditions were made the same as at first the power factor dropped back to within one-tenth of one per cent. of the average of the first five readings. The application of this method has eliminated practically all the uncertainty that used to attend the testing of synchronous motors and it has been shown that many cases of abnormally high or abnormally low power factor as measured by indicating wattmeter were simply the result of inaccurate readings and that when this method was substituted the results obtained were quite normal, and tests made under different conditions and at different times could be intelligently compared.

In testing three phase motors, whether balanced or unbalanced, providing, as is usually the case that the position of the voltage of the three phases is known, and that the curves are approximately sine curves, the power factor can be determined from the wattmeter readings only when connected in the two wattmeter system.

For let the first current be I, and the first voltage V, it is desired to find the lag ϕ of the current behind the voltage.

Let $V_2 = K V_1$ when K is known constant. Let V_1 lead V_2 by known angle. Let indication of wattmeter with current I and voltage V_1 be W_1, and indication of wattmeter with current I and Voltage V^2 be W_2.

$$\text{P F} = \frac{W}{V I} = \cos \phi$$
$$W = V I \cos \phi$$
$$W_1 = V I_1 \cos \phi$$
$$W_2 = V_2 I_1 \cos (\phi - \delta) = K V_1 \cos (\phi - \delta)$$

If ratio of wattmeter reading is R:

$$R = \frac{W_2}{W_1} = \frac{K V_1 I_1 \cos (\phi - \delta)}{V_1 I_1 \cos \phi}$$
$$\frac{R}{K} = \cos \delta + \sin \delta \tan \phi$$
$$\tan \phi = \frac{R}{K \sin \delta} - \cot \delta$$

In a three-phase system using voltage A B as V_1 and A C as V_2:

$$\tan \phi = \left(\frac{R}{\sin 60} - \cot 60^\circ\right) = \frac{2R}{\sqrt{3}} - \frac{1}{\sqrt{3}}$$

As it is usually desirable to obtain the angle of lag of the current in A with respect to voltage half way between AB & AC, This equation for balanced loads becomes:

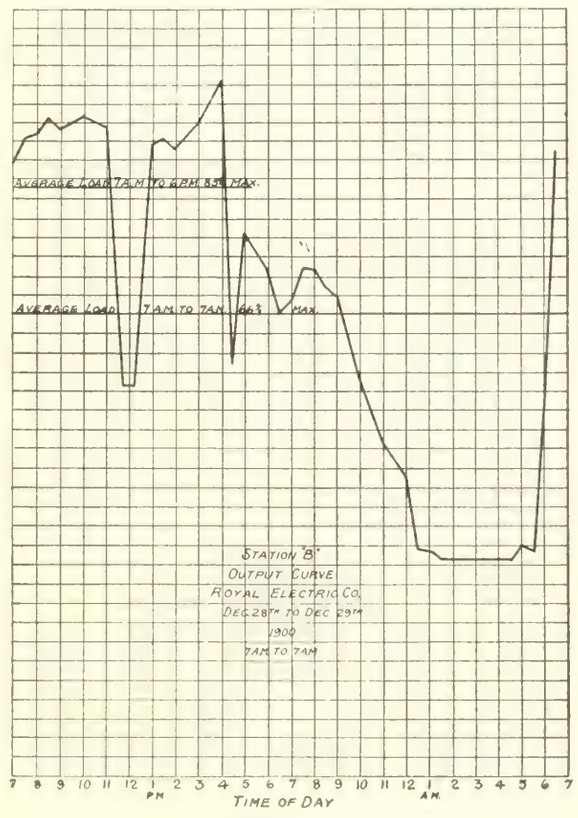


FIG. 7

$$\frac{W_1}{W_2} = \frac{\cos (30 - \phi)}{\cos (30 + \phi)} \text{ from which}$$
$$\text{Tan } \phi = \sqrt{3} \frac{W_1 - W_2}{W_1 + W_2} = \sqrt{3} \frac{I - R}{I + R}$$

For values of lag such as are common, between 0 and 60° this approximates

$$\phi = 60^\circ - \frac{60}{R}$$

The variation of power factor, with variation in the ratio of these meter readings, is very well shown graphically in Fig. 5, which method was originated by Mr. Frankenfield. In this diagram the two curves

W_1 and W_2 are plotted from the equations
$W_1 = V_1 I_1 \cos (30 - \phi)$
$W_2 = V_2 I_1 \cos (30 + \phi)$

The upper curve of ratios is plotted from the ratio of the magnitude of the ordinates of the two curves immediately below. To obtain the power factor, having the two wattmeter readings, divide one of the readings by the other, in such a way that the ratio will be less than 1. Ascertain whether the angle of lag is greater or less than 60 degrees, which can usually be determined by inspection, but if not it can be determined by increasing the load on the motor, when, if both indications increase, the angle of lag is less than 60 degrees, while if one indication increases and the

other decreases, the angle will be greater than 60 degrees. Select a point on the vertical scale of the upper curve, corresponding to the ratio found, and from this point draw a horizontal line, intersecting the curve, and from this point drop a vertical line on the power factor curve below, the point on the vertical scale opposite will be the power factor, and the point on the horizontal scale will be the angle of lag or lead. This method is applicable only to balanced circuits in which the voltage and power factor of the phases are equal.

As an example of what may be accomplished along the line of increased load factor in a comparatively short time if the problem is consistently and earnestly grappled with, let me draw your attention to the curves shown in Figs. 1, 2, 6, 7, 8.

In Fig. No. 1 is plotted the load curve of the Royal Electric Company's Station B, for July 30th and 31st, 1897, this being consequently the light summer load. In Fig. 2 is shown the load for Dec. 21st and 22nd of the same year. At this time there were no alternating current motors in operation, and the load represented is exclusively lighting. Under these conditions the load factor was 54 per cent. for summer and 43 per cent for winter. In Figs. 6, 7 and 8, is shown the effect of adding day load. Instead of operating all day under a load about half of the maximum evening demand, we find that the average load in Fig. 6 is actually 21 per cent. greater than what should be the peak. In Fig. 7 we have a maximum power load, 30 per cent. greater than the lighting peak, and this is the heaviest season for lighting. In Fig. 8 we have the almost unhoped for condition of an average load for the twenty-four hours greater than the maximum lighting peak. In Fig. 8 we have exactly the same power load as in Fig. 7, but there is added to it considerable lighting load, as the day was very dark and the effect of the business lighting coming on about four or five o'clock can be clearly seen. In Fig. 6 is shown very clearly the effect of the limited service contracts, as exactly at four o'clock the power load falls off, leaving the lines clear for the lighting, which reaches a maximum about an hour later and then falls steadily off, till about half past six, when a second lighting peak caused by residence lighting occurs. This steadily drops from about eight o'clock until at midnight, all the load with the exception of the all-night service, is off the lines.

Within a comparatively few years the possibility of a lighting station operating a load actually heavier during the light part of the day in summer than during the dark hours of the afternoon in winter would have been considered so improbable that it would have received scant consideration, but you have before you curves showing that this apparently paradoxical condition has been reached, and I think I may safely say that the conditions illustrated by the curves before you are as interesting and remarkable, as I believe they are unprecedented.

Notes on the Construction and Protection of Aerial Transmission and Distribution Systems.

By K. B. Thornton, Montreal.

In this country the majority of Transmission and Distribution Systems are of overhead construction, and are likely to remain so for many a long day. As these systems are exposed to all kinds of weather it is a matter of great importance to those who are operating the same that they be constructed and protected in the best possible manner. Aerial lines are constructed by placing wooden or iron poles in the ground generally at distances varying from 105 to 120 ft. apart in cities, and from 90 to 100 ft. apart for high voltage transmission lines in the country.

For wooden poles, cedar wood, owing to its lasting qualities is generally used up to lengths of 50 or 55 ft.; beyond this length they are hard to get of suitable proportions, the tops being often too small and the butts too large, and the price prohibitive. Apart from this cedar is also too brittle a wood to use for high lines. Spruce and pine poles are therefore used where lengths over 55 ft. are required, chestnut and other desirable woods not being obtainable in this country. As it is daily becoming harder to get long poles it is often necessary to resort to splicing poles to get the proper lengths.

Good cedar poles will last for twenty years and more without showing any signs of rotting but red pine poles will generally rot at the butt in cities in less than ten years, and spruce poles often show signs of rotting in four or five years, depending very much, however, on the nature of the ground in which the pole is located.

With a view to increasing the life of spruce and pine poles it is customary when placing them to coat the butts with a heavy coating of tar. The length of poles is governed by the conditions of locations. They are usually from 40 to 65 ft., and to clear high buildings, from 75 to 80 ft. Experience has shown that it is advisable to keep the lengths of the poles as short as possible, as they are less exposed to the weather, and it is generally a hard matter in Cities to guy them.

Throughout residental and suburban districts and for transmission lines through the country the usual length for poles is 40 ft. The following are some of the essential features of a pole contract:

Poles to be of good, sound, well shaped line cedar wood, not less than seven inches in diameter at the small end.

Poles to be cut square at both ends and the bark stripped off clear from the top to within six feet from the butt, and all knots to be neatly trimmed off; no pole will be accepted with two curves in it.

Poles will be inspected and branded at point of shipment, the inspector having the power to reject any pole that he may consider to be unsatisfactory.

Shaving Poles.—Poles when unloaded at the pole yard are inspected and shaved, the cost of shaving averaging about ¾ cent per foot.

Setting Poles.—In regard to the setting of poles no regular rule can be given for the depth which they should be set in the ground; usually it is from 5 to 7 ft., depending on the height, location and the condition of the ground in which they are located.

The following are the usual depths of setting in good ground;

Height of Pole.	Depth of Setting.
35 to 45 ft.	5 ft.
50 to 55 ft.	6 ft.
60 to 80 ft.	7 ft.

In marshy or "made" ground it is often necessary to concrete the butts of poles, using a mixture composed of one part of cement, three parts of sand and five parts of broken stone.

Up to a height of 45 ft. poles are set with pike poles and a dead man, and over that height with a derrick.

The number of men being as follows:

Height of Pole.	No of men required.
30 ft.	6 with pike poles.
40 ft.	7 with pike poles.
60 ft.	10 with derrick.
70 ft.	15 with derrick.
80 ft.	15 with derrick.

Should the poles be wet one or two additional men may be required on account of the extra weight. The gains are cut while the pole is on the ground and also when used in Cities the holes drilled for spikes.

When a pole is once set the earth is well tamped round the butt; this is especially necessary in the early Spring when the frost is not quite out of the ground, and if not properly attended to, the poles will get out of line in a very short time.

Spikes are of square wrought iron, 9 in. x 9-16 in—two men being able to drive about 500 per day of ten hours, once the holes are bored.

Cross Arms are usually of red or yellow pine and vary in length for ordinary city service from 2 ft. 6 in. for a two pin arm, about 8 ft. for a six pin arm, and have a sectional area of 3¼ x 4 ¼in. for all ordinary work; for transmission lines the dimensions will vary from the above depending on the nature of the transmission service.

Cross arms are rounded or chamfered on the top side to prevent water gathering and lag screwed to the poles with 7 in. x ½in. lag screws. Some prefer to fasten the cross arm with bolts passing through the poles, but our experience has been that it is easier to replace cross arms that have been lag screwed than those which have been bolted, as the bolts generally rust, making it necessary to use a drift to drive them out.

Braces.—All four and six pin arms should be braced with flat iron braces not less than 1¼ in. x ¼ x 27 in., bolted to the cross arm by 4 in. x ⅜ in. machine bolts at one end and either lag screwed to the pole with a 4 in. x ⅜ in. lag screw, or bolted to the next cross arm underneath.

On important transmission lines with long and heavy cross arms, where very strong work is required, braces of angle-iron in one piece are sometimes used.

A brace composed of one piece has some distinct advantages, for instance, some time ago one of the wires on a high voltage transmission line slipped off the insulator on to the cross arm, and the current to ground through the pole burned the cross arm

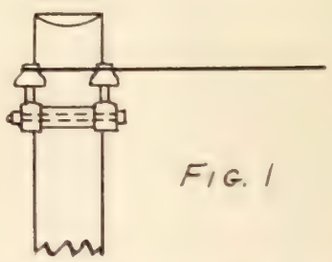


Fig. 1

clean off the pole, leaving the two outside ends of the arm supported by the brace, permitting the service to remain uninterrupted until such time as the line could be conveniently shut down.

Pins are fitted in holes drilled in the cross arms about 15 in. apart and 22 in. between the centre two pins, and secured by a wire nail driven through the cross arm.

After considerable experience with oak pins they have been abandoned in favour of 1½ in. locust wood pins, it being found that oak pins after five or six years were inclined to rot and break off at the shoulder when subjected to any great strain.

Where great strength is required at corner poles or for dead ending, it is advisable to use solid iron pins.

On long straight runs it is advisable to set the cross arms in such a way that they alternately face each other on adjacent poles and are back to back on the next two poles. In this way, should a stretch be cut down or a pole break, there is less danger

of the cross arms being wrenched off than if they were all set in the one direction.

At all long stretches, corners, and for dead ending, cross arms should be doubled, with a spacing block at either end of same and fastened at the ends by bolts run through the spacing blocks.

INSULATORS.—For regular line voltages of 2000 to 3000 volts, the ordinary deep grooved, double petticoat glass insulators are used; for higher voltages it is necessary to use specially prepared triple petticoat insulators of porcelain or a combination of porcelain and glass, so proportioned as to give the greatest distance between the point of support of the wire and contact with the pin and at the same time permitting of a minimum amount of surface leakage.

These insulators are ordinarily subjected to a break down test before being placed, in order to locate defects.

WIRE.—For all ordinary line work soft drawn copper wire is preferable to hard drawn, the disadvantages, in using it due to increase of sag being more than offset by the difficulties in handling hard drawn wire and the possibilities of damaging same when it is being erected.

As yet aluminum has not come into general use for overhead construction owing to the difficulty of making proper joints and the greater size of the conductor necessary to get the equivalent conductively of copper.

It is customary on city lines to use wire insulated with a double braid of cotton thoroughly saturated with an insulating compound.

Rubber covered wires for line work are of no use as the insulation will deteriorate in a comparatively short time, when exposed to all kinds of weather, rendering it worse than useless.

TIEING.—The line wire is secured to an insulator at each cross arm, being laid in the groove of the insulator and tied with a short length of wire about one or two guages smaller than the line wire.

JOINTING.—The ordinary twist joint is used except on very heavy wires of No. 000 guage and over, when it is better to use a lap joint as it runs over the cross arms easier when the wire is being strung.

DEAD ENDING.—Lines are generally dead ended, on double cross arms, the wire being twisted round the insulators and then back on itself, and the tie wires soldered to the line wire on the last two or three poles. (Fig. 1.)

For high voltage lines, a dead ending arrangement, consisting of a series of globe strain insulators is sometimes used, the line

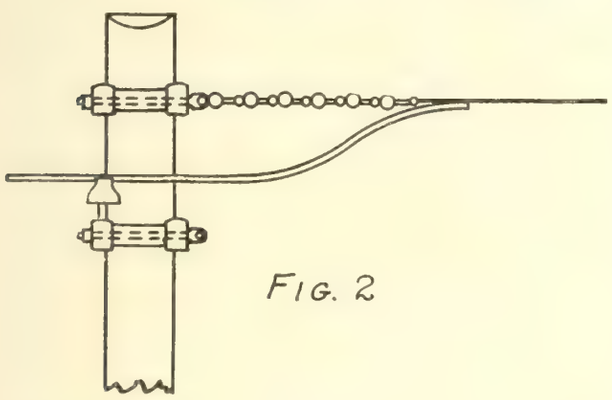


FIG. 2

being fastened to one end of a string of strain insulators, the other end of which is bolted through the cross-arm as shown in Fig. 2.

This system of dead ending is not altogether satisfactory as the insulation of the strain insulators deteriorates and breaks down.

Fig. 3 shows another method for dead ending high voltage lines, which has proved to be very satisfactory, although more expensive than that shown in Fig. 1.

With this arrangement the wire is tied round two insulators, supported on a special iron bracket which is bolted through the cross-arm, the centre of the wire being in line with the shank of the bracket.

STRINGING WIRE.—Wire when strung is subjected to mechanical strains due to weight, tension, variations in temperature and additional weight in winter due to ice, and when stringing wire in our Canadian climate, special allowanee must be made for variations in temperature.

Dynamometers are not ordinarily used to determine the tension of the wire strung, but experience has shown what sags to allow between poles for different sizes of wire.

The deflection of a wire supported between two points is given by the formula :

$$d = \frac{L^2 W}{8 T}$$

Where d = Vertical deflection at middle of span.
L = Length of span.
W = Weight of wire in lbs. per ft.
T = Maximum tension of wire in lbs.

The length of a wire in a span is given by the formula :—

$$L_1 = L + \frac{8 d^2}{3 L}$$

Where L_1 = length of wire and L = length of span

$$\text{or } d = \sqrt{\frac{3 L (L_1 - L)}{8}}$$

STRESSES.—Pole lines are subjected to various stresses which have all to be provided for.

These stresses are firstly, those due to the weight of the conductors and fixtures on pole, or the weight of ice on the conductors together with their weight tending to crush the pole, and secondly, those due to the lateral pressure of the wind on the pole and conductors, tending to break the pole by bending ; the action of the wind also has the tendency to break the pole near the ground due to vibration.

The danger due to crushing is not very great as there is always a very large factor of safety.

On one of the heaviest pole lines in Montreal the factor of safety for crushing under ordinary conditions is about 400. Once during the winter, after a very heavy sleet storm, this factor was reduced to about 240, owing to the extra weight of ice on the wires.

The stresses, however, which are most to be feared, are those caused by wind.

The same pole line mentioned was blown down in November last during a hurricane, about eighteen 70 ft. poles being broken.

McGill Observatory reports gave the velocity of the wind at 75 miles per hour which is equivalent to a pressure of 25 lbs. per sq. ft. This represented a total pressure on each stretch of this particular line, of 3,750 lbs., and there is no doubt if this had been applied as a constant pressure, that the poles and guys would have withstood same. However, the combination of the

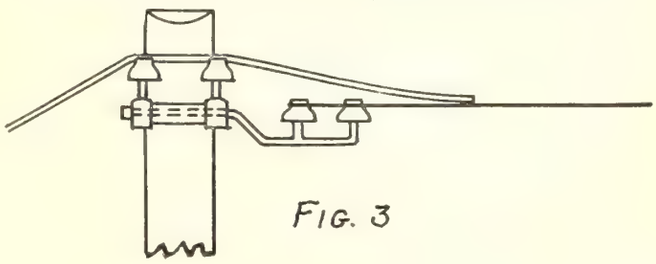


FIG. 3

DEAD-ENDING LINES

wind and the swinging of the wires evidently produced a strain in excess of the strength of the poles and guys.

GUYING.—All lines require lateral support in the shape of braces or guys to withstand wind stresses, the poles themselves when loaded with wires being unable to withstand same.

In the country, poles can be side braced with short wooden poles or guyed with anchor rods, but in cities this is impossible and guy wires have to be used.

Galvanized iron or stranded steel is used for guy work, the stranded steel being preferable as it is much more flexible and its weight length for length considerably less.

On long, heavy lines, poles in addition to being side guyed, should be guyed with crossed head guys every four or five stretches to prevent the line running back or the poles breaking, should any single pole in the line break or a stretch be cut or broken down.

Where there are several cross-arms on a pole the "Y" guy is most useful, and at points where circuits dead end on one side of a cross-arm—"Y" guys should also be used to prevent the arms being twisted out of line.

The practice of guying to trees and buildings should be avoided in all cases, for aside from making poor anchors for guys, they are subject to removal at a minute's notice from the proprietor and the company owning them is also liable for damages.

LIGHTNING PROTECTION.—The protection of aerial lines from the effects of lightning storms, is a matter which has received considerable attention from all central station engineers operating overhead systems.

With the advent of high tension transmission lines, the difficulty of effectively protecting same has been greatly increased.

Over-head systems may be affected in the three following ways :

(1) By direct strokes.
(2) By induced discharges.
(3) By electrostatic induction.

Fortunately for electric installations, direct strokes do not frequently occur for probably no arrester would be of much service in preventing such a discharge from doing considerable damage.

Induced discharges following a lightning flash and static charges, due to surrounding atmosphere being charged, are the conditions which have to be specially provided against.

Owing to the high frequency of lightning discharges any inductance on the line offers an enormous impedence to a discharge, which fact accounts for the rupturing of transformer coils, the discharge taking the shortest and most direct path to ground.

Arresters are non-inductive resistances usually air gaps, one side being connected to the line and the other to earth, the resistance of these gaps being low enough for the lightning to choose same for a path to ground rather than through some of the apparatus connected to the lines.

The length of the gap is governed by the working voltage of the line, the general practice of the day being to make it as small as possible without the ordinary current jumping across. However, this has the disadvantage that arresters are apt to be too sensitive and cause trouble due to dust, cobwebs and dirt accumulating, or the fusing over of the spark gaps due to repeated discharges, thereby causing a short circuit on the line or

a heavy ground as the dynamo current follows the lightning discharge across the gap.

A lightning arrester, in addition to affording a short path to ground, must also perform the duty of an arc breaking circuit breaker to immediately interrupt the flow of the line current to ground and extinguish the arc which is formed.

Owing to the fact that any inductance in the line offers considerable resistance to the passage of a lightning discharge, choke coils are sometimes introduced in series with the line, between the arrester and the central station, the combination of arresters and choke coils forming a very reliable means of protecting the apparatus in the station.

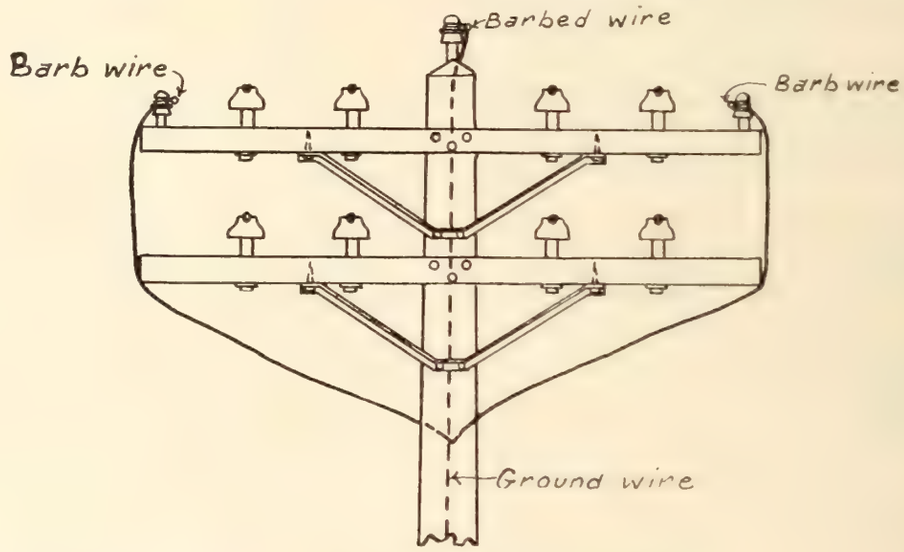
It is not a general practice to install a choke coil in conjunction with every arrester placed on the line, owing to the high cost which would be involved; however, it is a good scheme to place such a combination to protect any large and expensive apparatus connected to the circuits.

These choke coils are usually constructed of flat copper strip wound on a non-conducting core, the layers being insulated with mica or some other insulator.

Any self induction in the way of coils or turns in the ground wire of an arrester must be avoided and when they are being put up, the linemen should be watched, as it is a favorite trick to take up any slack in a wire by making a little coil ; any such coils would be nothing more or less than choke coils which would completely offset the value of the arrester, rendering it virtually useless.

The ground wire is a most important feature in the installation of a lightning arrester and there is no doubt that many failures of arresters to protect lines are due to poor ground connections.

To effectively protect a circuit, arresters should be placed at the end of all lines and at points where they branch off in different directions and they should be inspected and cleaned from time to time.



Despite the many devices used on the various types of arresters to extinguish the arc formed, the line current is occasionally not broken, thereby causing a short circuit or dead ground. To avoid this fuses are sometimes placed on the ground wire of single pole arresters and in both leads of double pole arresters ; this however makes it specially necessary that an inspection be made after every storm so that should any fuse be blown it can be replaced before the next storm.

Barb Wire.—Owing to the somewhat uncertain action on lightning arresters barb wire has been used on transmission lines as a protection against lightning, and the results obtained have clearly demonstrated that it is a most satisfactory means of protection.

Barb wire is usually strung on pins on top of the poles and also at the ends of top cross-arm. In some places a special two pin cross-arm has been used above the line wires, to carry the barb wires, and in other places a single line of barb wire is strung on top of the pole.

Experience has shown that it is advisable to fasten the barb wire to glass insulators on pins rather than to staple it to the pole owing to the superior mechanical support, the insulator of course not being used for insulating purposes.

Some engineers consider that the trouble caused by using barb wire offsets its value as a protective device ; and for that reason its use has been abandoned in one or two instances.

A description of the methods adopted to protect the Chambly 12,000 volt transmission lines from lightning may be of interest as the results obtained on the two lines have been eminently satisfactory.

Two duplicate lines are run from Chambly to Montreal, the total distance being about 17 miles for each line, of which 14½ miles are aerial and 2½ miles underground cables. The underground cable is divided up in three sections, the first section being about a mile and a half from the power house, the second about fifteen miles from the power house, and the third at the Montreal end.

The country through which the lines pass is very flat and marshy towards the Montreal end. Three lines of barb wire on glass insulators are run on each pole line as shown in Fig. 4, two lines being run on the ends of the top cross-arm about fifteen inches from the line wire and the third on a pin on top of the pole.

The barb wire is composed of two twisted No. 12 B.W.G. galvanized iron wires with one four point barb every five inches, and is connected at each pole by means of a soldered joint to the ground wire. This ground wire is stapled down the face of the pole and is twisted several times round the butt, after running through an iron pipe about eight feet long, which projects above the level of the ground, preventing the wire from being cut or broken, as well as affording an additional ground.

The ground wire and pipe were stapled on the pole when the poles were being erected.

As the poles on the transmission lines are set ninety feet apart the barb wire lines are grounded about fifty-eight times per mile; this frequent grounding being one of the most important points in the protection.

It was the intention before putting the lines into use, to place lightning arresters in addition to the barb wire, but as they were not available in time the lines were put into operation without them.

Our experience with the first series of storms showed that well grounded barb wire was a very effective protection, and the lines were therefore operated under these conditions for one entire summer.

Recently arresters of the air gap type have been installed at the power house at Richelieu as additional protection.

During one particularly severe storm the local distribution lines in Montreal and Chambly, which were not protected by barb wire, were considerably affected, while no effects were felt on the transmission lines at all, although trees were struck in its immediate neighborhood.

It was at first thought that the barb wire would rust and break down very quickly, but after two years operation an inspection shows that it is in a very good condition, and as yet there has never been a single case of it breaking.

SOCIAL FEATURES.

The social features announced on the programme were all carried out on time, and afforded much instruction as well as enjoyment to the visitors. The showers of rain which fell at intervals during the convention, came so opportunely as not to interfere with the carrying out of the programme.

At the close of the business proceedings on the first day, a carriage drive was provided by the citizens, enabling the visitors to view to advantage the many features of interest in and about the city. In the evening by the courtesy of the Ottawa Electric Co., a visit was made to Brittania-on-the-Bay, a delightful summer resort abont eight miles distant from the city, where music was provided by the local Regimental Band.

At noon on Thursday a group photograph of the members was taken on the steps of the Parliament Buildings. At the close of the afternoon business session, the Ottawa Fire Brigade gave an interesting exhibition of their modern fire-fighting appliances, and the promptitude and skill of the firemen in the use of the same. At 9 p.m. upwarps of one hundred members and invited guests of the Association assembled in the dining hall of the Russell House, to participate in the Annual Association Banquet. The function, which was presided over by the President, Mr. A. A. Dion, was a most successful and enjoyable one. The toast list was as follows :—"The King," to which the company

heartily responded by singing the National Anthem; "Our Guests," responded to by His Worship, Mayor Morris, and Mr. Warren Y. Soper; "Kindred Associations," to which Mr. Fred. Nicholls responded on behalf of the National Electric Light Association; Mr. Thos. Ahearn, for the American Institute of Electrical Engineers, and Col. Anderson for the Canadian Society of Civil Engineers; "The Press" and "The Ladies." A choice programme of instrumental music was rendered during the evening by the Orchestra of the Governor General's Foot Guards, and some capital songs were sung by Messrs. Frank Buels, J. E. Miller, and Chas. Watt.

On Friday afternoon, after the close of the last business session of the convention, visits were made to the power houses and other points of interest at the Chaudiere, and afterwards by courtesy of the Hull Electric Co. to Queen's Park, Aylmer, and to the power houses of the Hull Electric Co., and the Capital Power Co. at Deschenes Rapids. While at Aylmer a cordial vote of thanks to the Local Committee for their untiring and successful efforts to insure a pleasant time to the visitors was passed on motion by Mr. E. D. McCormack.

CONVENTION NOTES.

"You're no better than nobody else" was the retort flung back by a French Canadian hack-driver at a confrere who objected to to being "backed into" by the man in front, during the carriage drive. To an enquiry as to where he was going, the same individual replied, "I can't help it; I hev to follow the fellow behin; don' I?"

The tendency to substitute very large for small units is well exemplified in the new generating stations at Ottawa and Deschene. The simplicity of these stations is in striking contrast to the complexity of those of an earlier period.

The visitor is impressed with the fact that current is being cheaply produced in Ottawa by seeing electric lights burning in shop windows at almost all hours. The flat rate consumer evidently believes in getting his money's worth.

One of the beautiful sights was the glowing line of incandescent lamps which light the tracks of the Ottawa Street Railway Company's line to Brittania on the Bay a beautiful pleasure resort which the Company has established eight miles distant from the city. Every other pole on this line carries an incandescent lamp. The delegates were carried over the line at the speed of a mile in two minutes.

Mr. J. A. Burns, of Montreal, had his pockets filled with steel paper knives with bone handles on which was displayed the name of Munderloh & Co., Montreal, dealers in electrical supplies. There was a large demand for this useful souvenir.

Mr. E. E. Carry on behalf of Messrs R. E. T. Pringle, presented the delegates with a useful souvenir in the form of a pocket measuring tape the case of which bore the name and address of the donors.

Mr. Frederic Nichols, has forwarded a cheque for $20 to the chief of the Ottawa fire department in token of his appreciation of the creditable exhibition afforded the visitors of the efficiency of the brigade.

Mr. Geo. Sadler, of Lindsay, was one of the verterans of the convention, and appeared to thoroughly enjoy himself.

MR. P. G. GOSSLER.

Mr. Gossler, the newly elected President of the Canadian Electrical Association, was born in August 1870, at Lancaster, in Columbia County, Pennsylvania. In 1890, when not quite twenty years of age, he graduated from the Pennsylvania State University as Mechanical and Electrical Engineer.

After a short service with the Chester Foundry and Machine Co., of Chester, Pennsylvania, and with the Edison Electrical Company, at their New York Office, he joined, in April, 1891, the staff of the United Electric Light & Power Company, operating several lighting stations in New York City, and remained with that company as Electrical Engineer, until about May, 1895, when he came to Moutreal to take the position which he now holds of General Superintendent and Electrical when he came to Montreal to take the position which he now holds of General Superintendent and Electrical Engineer of the Royal Electric Company.

His experience with these two companies has been very varied and extensive. While connected with the United Electric Light & Power Company, of New York City, he designed and constructed the extensive distributing switchboards for handling the large business in incandescent lighting, and was also actively connected with and engaged in the placing of the underground cable system of that company, covering the city up to 125th street.

His work with The Royal Electric Company has, as is well known, been of the most extensive and varied



MR. P. G. GOSSLER,
President Canadian Electrical Association.

character, including the re-arrangement of all the distributing circuits, the re-construction of the generating plant, and the extension of its system from a service of less than 50,000 lights to upwards of 115,000 lights and some 10,000 horse-power for motor service, together with the extensive system of street lighting service. He is also very actively engaged in and has supervision of the works at Chambly, and their operation at the power house and in Montreal is entirely under his direction.

He has kept himself fully in the forefront of practical electrical work as applied to lighting and power service. He is a member of the American Institute of Electrical Engineers, and is recognized as an authority in electrical as well as mechanical and hydraulic work.

Immediately on his arrival in Canada Mr. Gossler connected himself with and took an active interest in the Canadian Electrical Association. His abilities were at once recognized, and he was appointed a member of the Executive and other important Committees. In appreciation of his valuable services, he was elected first vice-president and at the recent convention in Ottawa, was accorded the highest position in the gift of the Association. There exists the utmost confidence that during his term of office, as president, he will adorn the position, and promote in the highest possible degree the interests of the Association.

ACCIDENTS TO RESERVOIR DAMS.

By C. Baillarge, Mem. Am. Soc. C. E.

The late washout at the reservoir dam at Middlefield, Mass., and that at Chicoutimi, Que., can only avail as lessons in "The Instructiveness of failure" when the way in which they occurred can be made known to the profession.

True, it has been shown that in the Middlefield case, where the dam was but 20 feet high, and the level of the spill-way 15 feet, the gates over the spill-way could not be opened due to their faulty construction and that the water rose till it poured over the dam and caused its destruction; but how the erosion could have caused the wreck is not explained, in view of the fact that between the outer walls of the dam which was 30 feet in breadth and abundantly heavy and strong to resist any pushing or forcing of the dam forward as at Boazey in France, Austin in the United States and elsewhere, there were two intermediate bulk heads or walls of 2-inch matched sheet piling on boarding.

No gradual erosion from the top downwards could therefore have occurred on account of these intervening water tight partitions. The only way then of explaining the washout through and through the dam, is this: the overflowing water, first wore away the outer, lower or down stream of the three vertical sections of earth work into which the dam was divided by the bulk heads, taking with it the rubble work of the revetment wall, the component stones from which were found as far as 500 feet down the river.

When this outer or lower portion of the dam had crumbled away, the lower of the two bulk heads followed suit, after which the over-pour of water immediately attacked and scoured away the middle section of the earth work, followed by the overthrow of the upper or inner bulk head, and this by the immediate cutting through and down, by erosion, of the inner or up-stream section of the earth filling with its protective wall of dry rubble.

Where a portion of the clay filling was resistent enough to hold its own against the scour, up to a certain height from bottom level of reservoir, the portions of the bulk heads above that level, were of course broken off at level of top of remaining clay by the direct pressure of the water behind them.

The Middlefield mishap is therefore a case not of the bursting of a dam, not of a bodily pushing away of the dam as at Austin, but one where the dam failed, as do the levees along the Mississippi, by erosion of the water from above downwards.

We shall now see that the accident at Chicoutimi is a case of erosion from below upwards. The dam across the Chicoutimi, which is one of the out-flows or discharges from Lake Kinogami and its smaller companion as expressed by the diminutive "Schish" Kenogamischish, is about a mile from the city or town of Chicoutimi, the Metropolis of the Saguenay District.

The dam is built at right angles across the stream, a powerful one emptying into the Saguenay river. It is a wooden structure of crib work with a base up stream of about 3 to 1, planked over with a water tight flooring and relying for its stability on being kept down and in situ by the very weight of water above it, some 20 feet higher than on the down side, and though, the higher the water within the reservoir the greater the thrust outward or downward, the greater also the weight upon the dam and its adherence to the bottom on which it rests and is probably bolted to.

Above the dam proper is a superstructure some 10 feet or more in height answering as a bridge or roadway between the opposite sides of the river and to the upper or up stream side of this superstructure are adapted a series of some 20 gates or more, but which as at Middlefield, must have been inoperative due to their great size under a head of some 10 feet of water against them; for the water on the occasion of the accident about to be related rose to 10 feet above its normal freshet level and evidenely pressed hard against the dam superstructure which is entirely too narrow, it being but 12 feet wide instead of 20 which it should have been; and to proof, it is now bulged down stream, wriggled and out of plumb as well as out of line.

Now while this dam of some hundreds of feet in extent across the river was solidly abutted against the river's high and rocky bank at one or its eastward end; the western end of it rested on or a few feet into the face of a bank of quite a different nature on the opposite side; where not only does the rock rise to or crop out at level of bed of river; but the material above it and for a height of some 50 to 60 feet is nothing but the most irresisting soft clayey sand and vegetable mold.

Had the precaution, an expensive one of course, been resorted to, as was done at Grand Mére on the St. Maurice, in an absolutely similar case, of rip-rapping the face of the cliff from the dam to some distance up stream or of a wooden revetment against wash and scour of river, the accident likely might not have happened. It would certainly not have occurred had this cliff revetment been made water tight to a certain height, even though it should have cost an extra $20,000 or more to do so along a stretch of 200 to 300 feet.

What happened is this: the water having on the occasion risen to 30 feet, a pressure of 13 pounds to the square inch or close upon 2,000 lbs. to the foot, a great tendency to filtration through the bottom of the bank (where the strain was irresistible by material of the light and loose structure alluded to) was brought about, and a leakage through and around the western end of the dam was seen to occur. Under such pressure and through such friable material it may easily be imagined how quickly the scour did its work, increasing in a few hours the water way through the bottom of the bank to the dimensions of a sewer and then enlarging sidewards and from below upwards, to the vastness of a tunnel, when of course the roof or over-lying earth caved in—the out rushing water in the mean time wearing away the side hill from below and causing the cliff to go piece by piece almost vertically in slices from 4 to 6 feet thick at a time, till the gap up stream from the dam reached to a distance of some 200 feet, while in the direction of the length or axis of the dam prolonged, the hill was cut into by not less than 300 feet and the scour down stream or below the dam wore away the bank of the river to a distance of more than 700 feet.

The quantity of material carried away—the cliff as already stated being some 60 feet high—is not less than 300,000 cubic yards discoloring the water of the Saguenay for miles below the town and rendering it for the time being unfit to drink.

The dam will of course now have to be extended by some 300 feet or more to the opposite bank or to the present site thereof, while a temporary dam will have to be built to confine the water to passing over the present dam till the extension is put in; but the whole structure should be widened out down stream by say 20 feet, to support a bridge and gate superstructure of some 25 to 30 feet in breadth and capable of holding its own against any subsequent rise of like magnitude in the river; and this should be done at any cost and in the company's own interests; for as the area of the reservoir or breadth of water upheld will hereafter be of so much greater an extent westward, a second accident of the kind might sweep down upon the city and destroy thousands of dollars worth of property, with probably or at any rate possibly loss of life for which the company might be held responsible—and a stitch in time saves nine.

I would also say here in relation to the new concrete dam at the Chaudiere—it was quite a question this spring whether it would not give under the immense ice pressure against its almost vertical inner or upper face, and my surmises of last fall when writing on the subject have now become a certainty, and to the effect that inward of this concrete rampart should be made an inclined apron of crib-work of two or three feet of base to one of height boarded over with deals or plank laid parallel to the flow of water, and such that any future tendency of an ice jam against the dam will be done away with by the certainty that the swell of the ice forward or down stream will shove it up the incline and topple it over the dam in a way to do no damage to the permanent structure.

PROGRESS IN ELECTRIC LAMPS.*

By Prof. Andre Blondel.

The object of this paper is to pass in review the improvments realised up to the present, and those still to be hoped for, in arc and incandescent lamps.

Progress In Arc Lamps—. During the past 10 years great strides have been made both as regards the theory and the contruction of arc lamps. Our theoretical knowledge of the properties of the arc has greatly inceased. The measurements of M. Violle have shown that the maximum temperatures reached in the arc 3,500°C. at the positive, 2,700°C. at the negative carbon, andalsothat in a closed space the brightness and the temperature of the crater are constant. Again, after adiscussion, joined in by many authorities, it seems now settled in conformity with the present author's conclusions that the back E.M.F. in the arc exists only as arising from the arc's resistance, which can be considerably modified by the addition of salts to the crater. Mrs. Ayrton's experiments have connected by simple laws various phenomena of the arc; in particular they have shown that the energy consumed is a linear function for each diameter of the carbon. That the apparent resistance varies not only with the diameter of the carbons and the length of the arc, but also with nature of the carbons and the surrounding gas has been shown by various experimenters. Mr. E. Wilson, repeating an experiment by M. Cailletet, has shown that the brightness of the positive carbon diminishes when the pressure is increased, and that by the withdrawal of gas a carbon mist is produced. M. Le Chatelier has attributed the constancy of the temperature of the crater to the presence of fusing carbon there. In addition, the author's experiments have shown that in free air the brilliancy of the arc increased with the current, and passes from 150 candles per square millimetre for small arcs to 220 candles per square millimetre for powerful arcs. Mrs. Ayrton, in her reserches on the hissing of the arc, discovered that the hissing is caused by the advent of oxygen at the crater; and that the phenomenon does not occur below certain current density, and is preceded by Trotter's phenomenon of the rotation of the arc on itself.

As regards the altenating-current arc the author has given a detailed analysis of its periods of lighting and extinction, and of its current and voltage curves; he has shown the parts played by the resistance and the self-induction of the circuit, the conductivity of the core, and the form of the E.M.F. curve of the generator.

The electric arc does not conform to Ohm's law, for increase of current produces widening of the arc, and consequently a diminution of the resistance. This leads to instability, which must be guarded against, on a constant-potential supply, by the inclusion of a resistance in series. This instability was studied by the author in 1891 by drawing "characteristic curves of extinction," in which the potential difference between the lamp terminals was plotted for various current.

As regards the mode of regulation, the differential system seems now universally admitted to be the best. We may take with the minimum voltage of 30 volts for the arc a potential drop of 1·5 volts in the steadying resistance for alternating arcs, and with 33 volts a fall of 3·5 volts to 4 volts in the resistance for continous-current arcs. The use of shunt-lamps presents some advantages over the differential system; the lamps are simpler; there is no risk of burning out by too strong a current; and they permit of easier regulation of the current within wide limits.

The oscillographic study of the extinction of the arc without additional resistance, shows it to take place slowly, the phenomenon requiring about 1 10sec. or even more for its completion. This indicates that with quick-acting and sensitive mechanism the normal arc may be uninterruptedly maintained with only small steadying resistance in series. The inertia of the moving parts leads to hunting however, unless the vibrations set up are rapidly damped by a dash-pot. In the best modern lamps, air dash-pots are employed, and the adjusting mechanism has reached great perfection. Arc lamps have numerous constructional conditions to satisfy. They must be able to stand rough handling and every weather, and must be capable of easy and qnick replenishment and repair. It is noticeable that of recent years there has been a tendency to revert to the use of clockwork mechanism on account of its great sensitiveness and small consumption of energy. As for motor mechanisms, they are rather complicated when continuous currents are used, but with alternating currents assume various elegant forms of the type of a metal disc embraced by electro-magnets of suitably differing phases. With certain types of mechanism in alternating current lamps the self-induction of the regulating coils tends to reduce the sensitiveness. This self-induction effect might be compensated, as M. Claude has suggested, by proper condensors. The self-induction, however, tends also to keep the impedance almost constant, in spite of variations of the resistance of the coils through temperature alterations, and so gives the alternating-current lamp some advantage over the continuous-current lamp. In the latter lamps ingenious temperature compensators have been adapted, but these unfortunately leave uncorrected the variations of the resistance produced by the shortening of the carbons. Improvements in mechanism have brought many good double carbon lamps into use; among these the Crompton-Pochin, Brockie-Pell, and Korting and Matheson lamps may be mentioned. The author has for a long time considered that these lamps are very efficient as regards the utilisation of the energy supplied. Besides this they require little labor and are economical in carbons.

Modern methods of lamp grouping differ greatly from the old system, in which the employment of isolated lamps was necessary. One modern tendency is, however, to use high-voltage enclosed lamps working directly at 110 volts; another is to use, as of old, two lamps in series, each absorbing from 30 to 35 volts. In both these cases the steadying resistance is important. But by the construction of differential lamps the importance of the steadying resistance is minimized. Low-voltage lamps have been in use since 1880, but it was not till atter 1897, when the Hegner (Volta) lamp appeared, that the low-voltage lamp entered largely into industrial practice. Siemens and Halske, as also Korting and Mathieson, in their low-voltage lamps use, at starting, a high resistance which is afterwards gradually removed. With these the fear arises that, in spite of the perfection of the mechanism, certain circumstances may lead to a dangerous increase of the currrent. Hegner, using also differential lamps, but without special mechanism, puts three in series with an

*Abstract o a paper read at the International Congress of Electricity, Paris

automatic rheostat of four parts, which are removed successively as the lamps get started, thus securing a more stable and less dangerous arrangement than the former. Still more recently Vigreux and Brille have proposed a special mechanism on the differential system which without springs, weights, or frictional appliances, can produce a very rapid recoil of the carbon if the arc becomes shortened. The advantages of these low-voltage lamps are that they enable a better distribution of illumination to be effected and that they are more economical as regards consumption of energy. Against these advantages must be set, however, the heavy initial expense, the complication and delicacy of the mechanism, and the necessity for carbons of very special quality.

With these lamps, grouping by threes is called for only on short, small-resistance circuits. When large areas are being supplied the leads furnish sufficent steadying resistance for the usual arrangement of two arcs in series. In any case it is only on circuits at 110 volts and when sub-division of the illumination is desired, that low-resistance lamps are specially useful. When, however, the distribution is made at 220 volts, and especially when 220 volts is to be substituted for 110 volts in an existing circuit, a reduction of the number of lamps under a given voltage should rather be aimed at. The solution of this problem is afforded by the enclosed arc lamp.

Illumination by arc lamps in series, with both continuous and alternating currents, is still much in vogue in the United States, but has been almost completely abandoned in Europe on account of the lack of independence among the lamps, and the dangers accompanying the use of high-pressure currents. A recent application in this direction in England consists in the employment of constant-current transformers and Ferranti rectifiers, and thus allows the use of lamps giving a better light distribution than alternating-current arcs. The pulsating current produced is, however, as dangerous as alternating currents. On the Continent commutator transformation to continuous current, or the use of alternating-current lamps with reflectors, is preferred.

The enclosed arc lamp did not assume importance till 1894. It is characterized by having a very long arc using a tension of 75 volts to 80 volts. In the Marks (or Jandus) lamp the arc is surrounded by a double globe, the inner one of which possesses a valve (check-gas plug), which permits expansion of the contained air. The outer large globe is protective, and becomes filled with gas from the inner globe. In these circumstances the carbons are consumed very slowly, and the arc itself is modified in character—the upper positive carbon is, through rotation of the arc, scarcely hollowed, the lower negative carbon is plane, while their normal distance apart is 8mm. at 80 volts. The mechanism of all makes of these lamps is of the most rudimentary type. And since the carbon consumption is small the displacement of the luminous spot is very little. The advantages of these lamps are: Their independence of one another, the ease of their application in 110 volts or 220 volts systems, the extreme simplicity of their mechanism, the employment of cheap carbons, the small consumption of the carbons, and the reduction in the amount of attention necessary. Their disadvantages are, on the other hand, the blue tint in the light, the variations of brightness which render almost necessary the use of a diffusing globe, the fouling of his by a silicious deposit, and the mediocrity of the ight fr om large carbons. The disadvantages attending the use of alternating-current enclosed lamps remain still so numerous that this type of enclosed lamp cannot yet be regarded as a success.

CANADIAN ASSOCIATION OF STATIONARY ENGINEERS.

At the regular meeting of Toronto No. 1, C.A.S.E., held on the 19th ult., the following officers were elected :—President, W. J. Webb ; vice-president, R. H. Johnston ; recording secretary, W. H. Johnson ; financial secretary, N. V. Kuhlman ; treasurer, S. Thompson ; conductor, T. D. Bly ; doorkeeper, J. Fox ; trustees, J. Huggett, J. Bannan, N. V. Kuhlman ; delegates to convention, W. J. Webb, J. Huggett, J. Bannan, W. L. Outhwaite and N. V. Kuhlman.

Hamilton branch has elected the following officers : F. J. Sculthorp, president ; J. A. Ferguson, vice-president ; J. Ironside, recording secretary ; G. W. Dawson, financial secretary ; W. R. Cornish, treasurer ; R. C. Pettigrew, conductor ; N. Kitchen, doorkeeper ; R. C. Pettigrew, Thomas Elliott, Peter Scott, trustees ; Joseph Ironside and T. Chubb, representatives to the convention to be held in Brantford on August 20th ; F. J. Sculthorp and J. A. Ferguson, alternates.

Toronto No. 18, on the 28th June elected the following officers :—President, Thomas Graham ; vice-president, John J. Richardson ; treasurer, P. Trowern ; financial secretary, W. Inglis ; recording secretary, John M. Dixon ; conductor, James Coulter ; doorkeeper, G. Gracey ; auditors, Joseph Hughes and A. W. Vance ; delegates to convention, J. M. Dixon and P. Trowern.

THE JOHN SCOTT MEDAL.

The Franklin Institute of Philadelphia issues each year a premium and gold medal which are awarded on account of what is considered the most noteworthy achievement in electrical science during that year. This is known as the John Scott Premium and Gold Medal.

We have recently been advised that the award for this year has been made to the General Electric Co., on account of their series alternating system of street arc lighting.

During the two and a half years the system has been before the public, 230 central stations have ordered 22,000 arc lamps for operation on this system, distributed in all parts of the world :—United States, Canada, Australia, Brazil, British Guiana, China, Costa Rica, Cuba, England, Mexico, Newfoundland, Peru, South Africa.

TO OUR READERS.

The advertisement pages of this number contain the announcements of the leading manufacturers and dealers in electrical appliances, and should therefore prove of much interest and value to our readers. These manufacturers will be pleased on request to send you full particulars of their goods, and will appreciate mention of their advertisements in the Electrical News.

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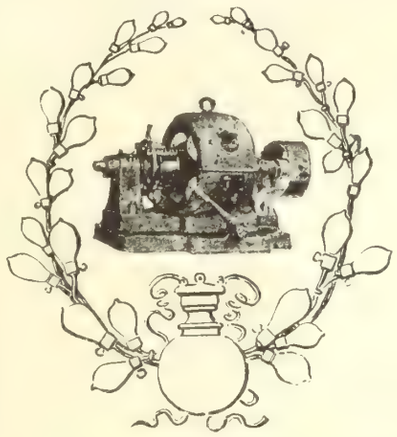
The United Electric Company, Limited, Toronto, has increased its capital from $150,000 to $300,000.

Supplementary letters patent have been issued increasing the capital of the Wire Cable Co., of Montreal, to $1,000,000.

The C. P. Co., Limited, of Montreal, have applied for a charter to manufacture electrical supplies.

Negotiations are under way looking to the extension of the St. Thomas street railway to Port Stanley, Ont.

A by-law to provide funds to extend the electric light plant was defeated by the ratepayers of St. Marys, Ont., on July 2nd.



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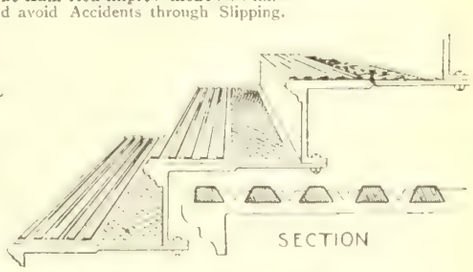
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SPARKS.

The city council of St. John, N.B., are considering the **taking over of the electric light plant now used for lighting** the suburb of Carleton.

The Summerside Electric Company, of Summerside, P.E.I., have ordered a 150 horse power Mumford boiler **from the Robb Engineering Company, of Amherst, N.S.**

The municipal committee, in reporting to the Trades and Labour Council of Toronto, recommended that an independent electrical inspector be appointed by the city to supervise all electric work.

The Shawinigan Water and Power Company, of Shawinigan Falls, Que., who have tendered for lighting the streets of Montreal, state that a transmission line will shortly be constructed into that city.

Chumppe—"Say, I want to register a kick. My telephone hasn't worked since I came into these new premises, and I can't see why, 'cause I moved it carefully and put it up myself."—Chicago News.

Conductors and motormen of the Hamilton, Grimsby, and Beamsville Electric Railway recently went on strike for higher wages, but a conference was immediately held and a satisfactory settlement arrived at.

Allen McDougal, of Three Rivers, Que., John Hyde, of Montreal, and others, are applying for incorporation as the Provincial Light, Heat and Power Company, capital $500,000, and head office at Three Rivers.

Messrs. G. E. Smith and E. D. Loring, Boston capitalists, were in Kingston recently for the purpose of forming a company to construct an electric railway between Napanee and Gananoque, passing through Kingston.

The Sackville Electric Light and Telephone Company, of Sackville, N.B., are making a number of improvements. A new power house is under way, in which there will be installed first-class electrical apparatus and a 100 h.p. engine and boiler.

The New Brunswick Telephone Company, of St. John, have elected the following officers: President, Hon. A. G. Blair; vice-president, J. L. Black; general manager, F. P. Thompson; secretary, W. E. Smith; directors, C. F. Sise, Chas. Fawcett, J. L. Black, A. A. Stockton, F. P. Thompson, W. T. Whitehead.

At the annual meeting of the Victoria Telephone Company, held at Baddeck, N.S., A.C. Ross was elected president and A. H. Sutherland secretary. A dividend of 10 per cent. was declared, and it was decided to extend the line to Sydney, Port Hood, and other points in Cape Breton.

ELECTRICAL REPAIRS

In the large and well equipped factories where the manufacture of electrical apparatus is carried out under the piece work system, they find that repair work or apparatus sent in to be repaired or rewound interferes with this system, and in many cases they would prefer not to do this kind of work, as it is almost impossible to do it with dispatch and at a reasonable price. Knowing the above to be a fact,

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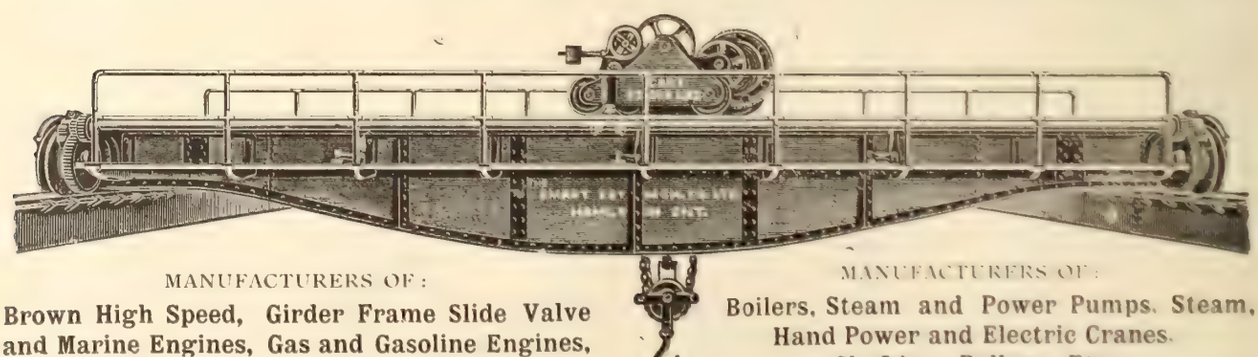
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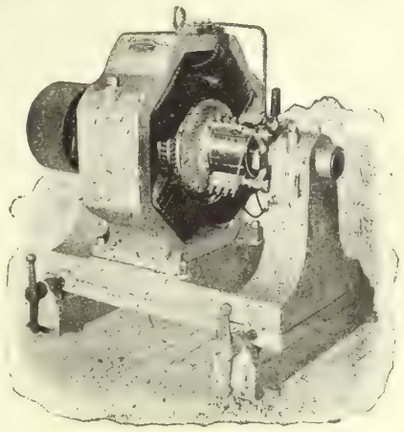
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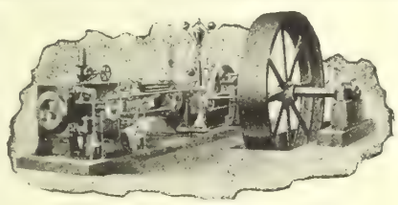


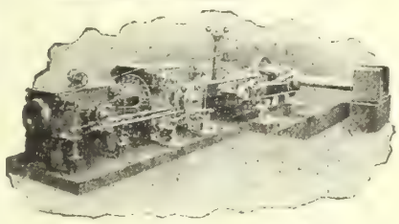
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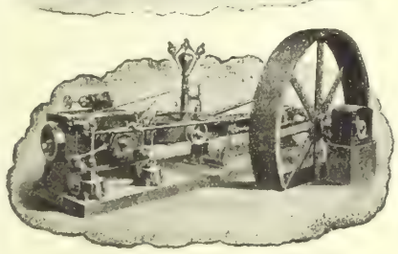
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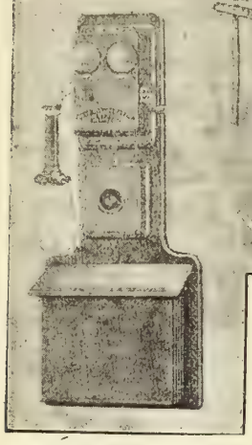
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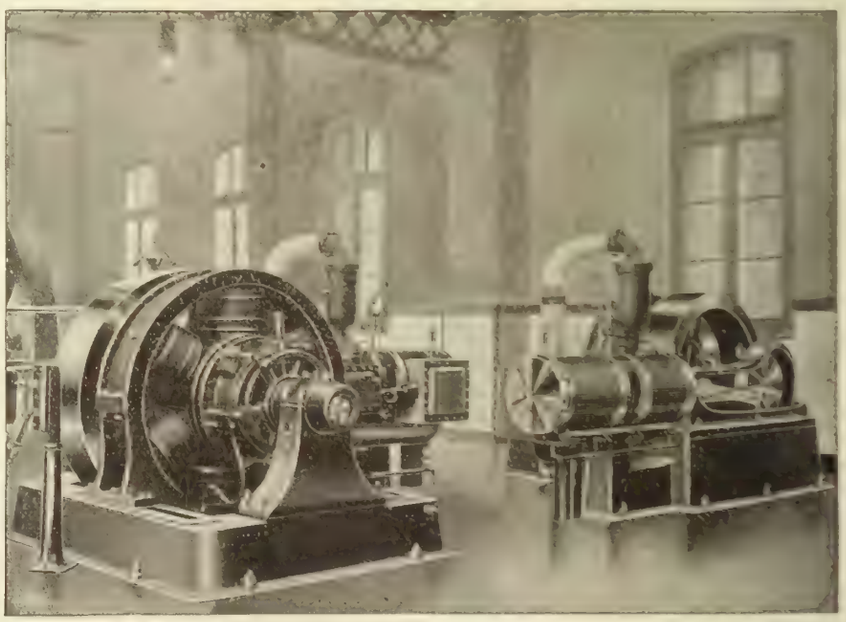
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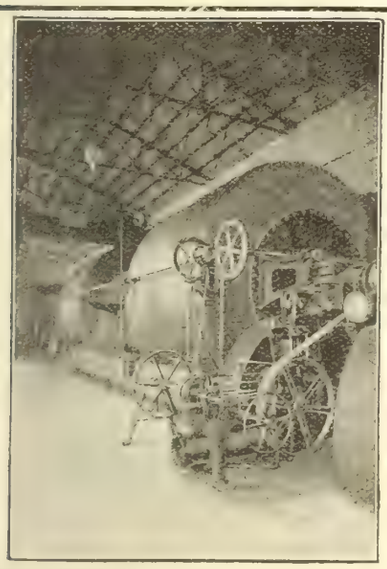
AGENTS { William McKay, 10 McKenzie Crescent, Toronto.
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SPARKS.

Application will be made for the incorporation of the Ampere Electric Manufacturing Company, of Montreal, with a capital of $50,000.

West Zorra and Embro township council will submit by-laws to the ratepayers to raise $50,000 for an electric railway to be built through the municipality.

A Toronto inventor has produced a street car fender which has attracted some attention. It runs about three inches from the rail, a roller being at the bottom, which can be dropped right on the rail by the release of a handle standing beside the brake, and within easy reach of the motorman's hand. Most of the fenders are dropped by the pressure of a button by the motorman's foot, and this is felt to be too insecure, as in the hurry of the movement the motorman cannot always reach the exact spot with his foot. The fender drops automatically also when it hits any heavy body, and at the same moment a flow of sand is released on the wheels, which stops them very quickly. The feature is regarded as valuable one. The fender is of steel hoops, very flexible, which will not hurt anyone falling against it.



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WRITE FOR CATALOG. DEPT. E.

TRADE NOTES.

The Waterous Engine Company, of Brantford, have furnished a new engine for the electric light plant at Parry Sound, Ont.

The Robb Engineering Company have supplied an improved Mumford boiler to the Summerside Electric Company, of Summerside, P.E.I. This boiler will be fitted with the Jones underfeed stoker.

The Stillwell-Bierce & Smith-Vaile Company, of Dayton, Ohio, are now at work on a water wheel plant for the Brownville Board Company, of Brownville, N.Y. The order consistt of four pairs of 33-inch cylinder gate Victor turbines, each pair mounted horizontally on a steel centre discharge case.

The Smart-Eby Machine Company, of Hamilton, are sending to their customers general catalogue No. 2, descriptive of the various lines manufactured by them, including engines, boilers, steam and power pumps, shaking grates, shafting, pulleys, etc. The catalogue gives much necessary information and data.

The water power on the Catawba river at Rhodhiss, N.C., is one of the largest in the United States, and will be utilized for cotton manufacturing and other industries. The S. Morgan Smith Company, of York, P.A., recently shipped to the Rhodhiss Mfg. Company two pairs of 36-inch and one single 30-inch McCormick turbines, mounted in iron cases, as well as head shafts, couplings, bearings, and a 1,000-gallon fire pump.

Mr. C. P. Folsom, engineer for the Stillwell-Bierce & Smith-Vaile Company, Dayton, Ohio, has just secured a large order for Victor high-pressure turbine water wheels from the Ouiatchouan Pulp Company, Ouiatchouan, Que. The wheels will be used under 240 feet working head, and the mill will have a daily capacity of 30 tons of pulp. The order includes two 1,000 h.p. wheels for driving the pulp grinders, one 500 h.p. wheel for driving the screens and wet machines, and one 100 h.p. wheel for driving their electric plant.

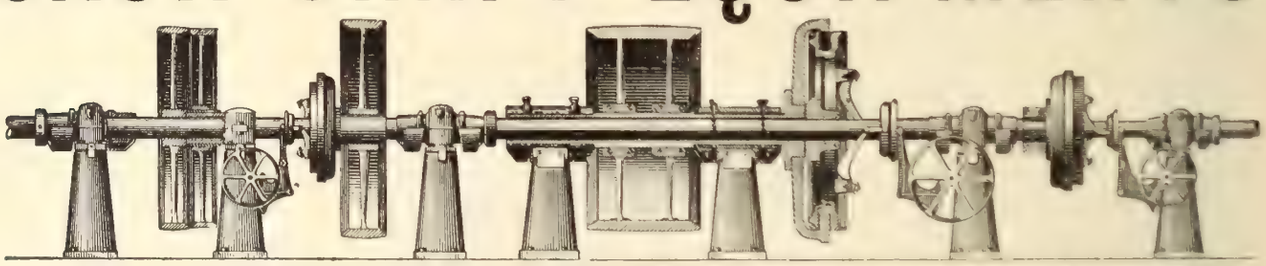
A four-storey addition has recently been built to the works of the Eugene F. Phillips Electrical Works, Limited, at Montreal, by which the floor space is increased 7,500 feet. The most modern machinery has been put in for increasing the capacity of the wire drawing and braiding departments. Notwithstanding that the capacity of the factory to produce bare wire has been doubled and the production of insulated wire increased by fifty per cent., it is found necessary to operate day and night in order to keep pace with orders.

The Stillwell-Bierce & Smith-Vaile Company, of Dayton, Ohio, recently shipped to the North Carolina Electrical Power Company, of Marshall, N.C., one of their 27-inch improved cy,inder gate Victor turbines on a horizontal shaft in a wrought iron flume. The wheel was made entirely of bronze, and under 60 feet working head of water will develop 750 h.p. The power of this wheel will be used for driving the plant of one of the street railways of Asheville, N.C. The shipment also included 70 feet of steel feeder pipe, three sets of head gate irons and the necessary water rack.

The Electric Engineering & Supply Company, 21 Bleury street, Montreal, have supplied and installed during the last month two depositing generators, one for the Gazette Printing & Publishing Co., and the other for the Hughes Electrotype & Stereotype [illegible]

The Sprague Electric Company, New York, are now building at their shops, three generators for the Lackawana Iron & Steel Co. for their new plant at Buffalo, N.Y., consisting of three 500 KW engine-type machines, with a speed of 100 r.p.m. These generators will each weigh about 30 tons. This contract was secured after severe competition with other leading manufacturers, and a thorough investigation on the part of the engineers of the Lackawana Co. of the apparatus manufactured by the different concerns, and an inspection of their factories and capability to fulfill the contract. These generators are equivalent in size to the [illegible] KW

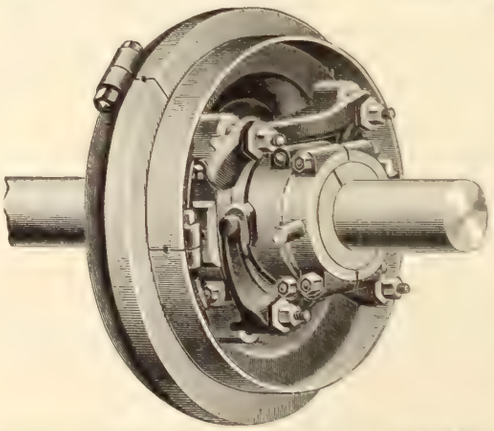
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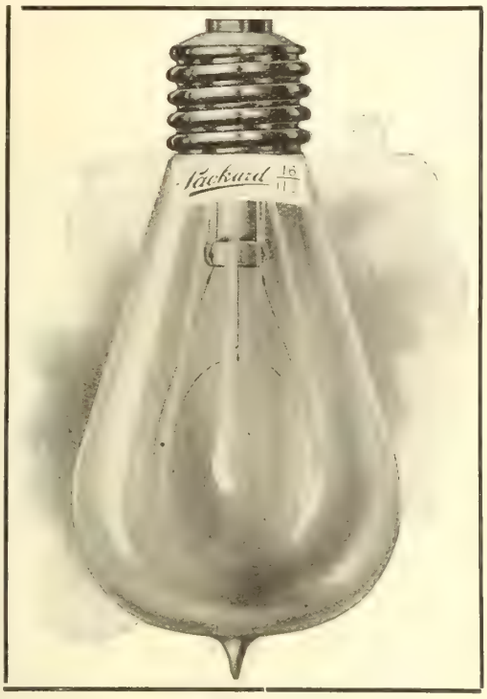
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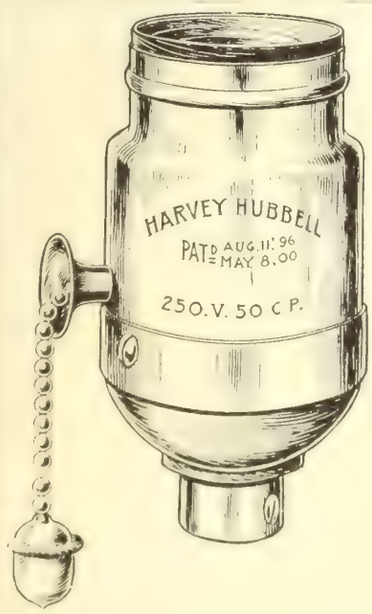
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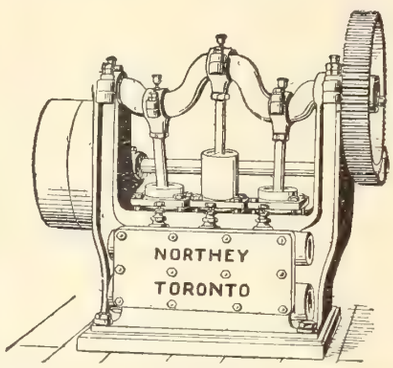
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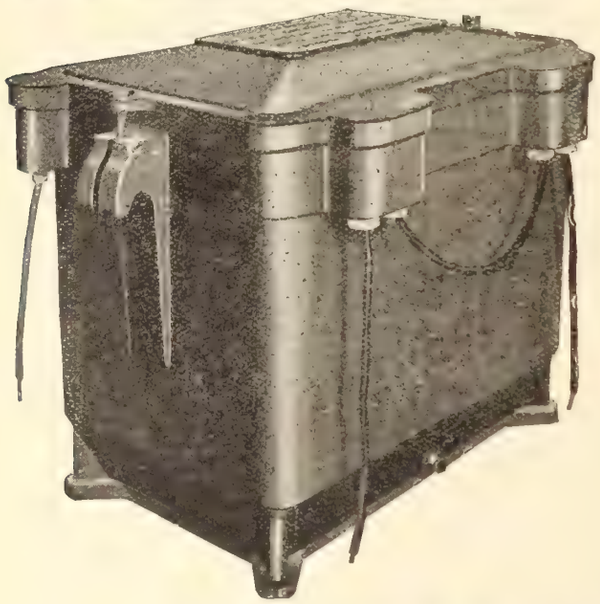


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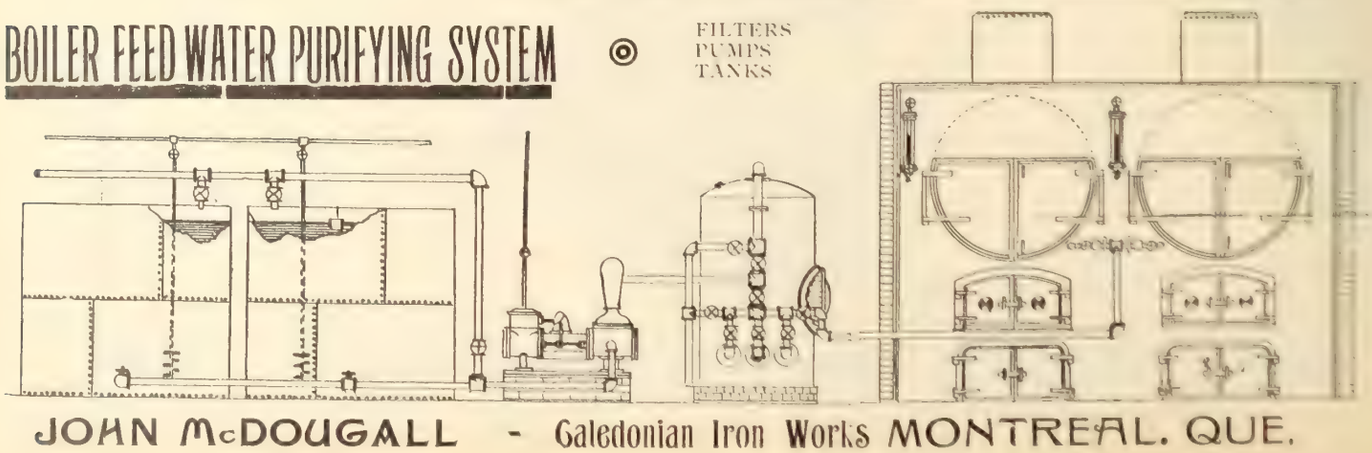
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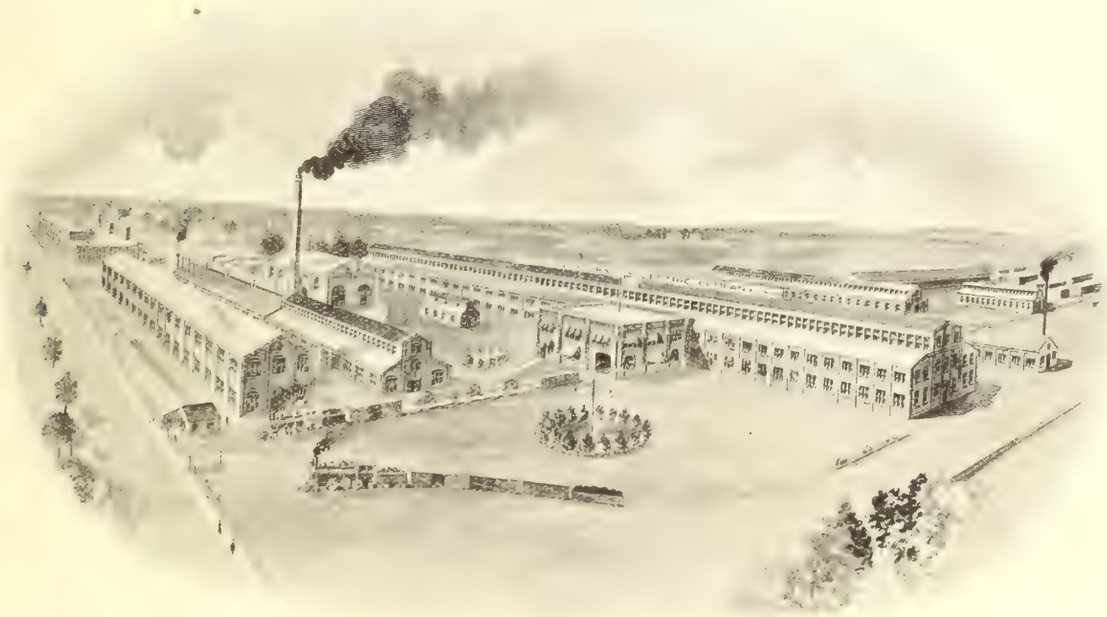
CANADIAN
ELECTRICAL NEWS
AND
ENGINEERING JOURNAL.

VOL. XI. AUGUST, 1901 No. 8.

A CANADIAN MANUFACTORY OF ELECTRICAL APPARATUS.

FEW of our readers realize the magnitude to which the electrical enterprises in this country have developed, and that it has been a matter of great difficulty for the factories to keep pace with the rapidly growing demands, the result being that many orders were given to manufacturers outside of Canada.

In order that Canadians might reap the advantages of home production in electrical apparatus, the Canadian General Electric Company have recently enlarged their extensive works at Peterboro, of which the accompanying illustration gives a very good idea.



VIEW OF THE WORKS OF THE CANADIAN GENERAL ELECTRIC COMPANY, PETERBORO, ONT.

The "electric works" are now employing about 600 hands, giving them first place and high esteem in that thriving community of ten or twelve thousand souls. It is impossible to approach or leave the town without seeing the handsome buildings within the enclosure of about 40 acres. There are nearly twenty buildings, all reached by track, and all raw material or finished product is delivered or taken away by means of switches to the main tracks of the Canadian Pacific Railway and the Grand Trunk Railway systems.

The largest building is the machine shop and office building; it is 540 feet long, 110 feet wide, and 60 feet high, with a gallery 25 feet wide on each side.

The next three largest buildings are 272 feet long, 50 feet wide, and two stories high. The one on the left is devoted to the manufacture of incandescent lamps and covering wire. The second building is for storage and compounding wire, also making rubber covered wire. The small building in the rear is the boiler house, providing steam for heating, etc. The other buildings on the right are used for smithy, foundry, carpenter and pattern shop, etc. The buildings in the left background are utilized for the manufacture of carbons and porcelain goods.

Motive power is being supplied from the Company's generating station at Nassau, about six miles distant, where the development of a fine water power of 1500 horse power is nearing completion. The water wheels are of the horizontal turbine type, supplied by the Wm. Hamilton Company, of Peterboro. To them will be direct connected two 450 K.W. three-phase revolving field generators, operating at 138 r. p m. and generating current at 60 cycles and 6,600 volts. There will also be provided a marble switchboard arranged so that either machine and line may be operated separately or in parallel.

The current will be transmitted to the works on two three-phase lines, constructed of No. 1 B. & S. copper wire in the triangle form, one circuit on each side of the pole. Four feet below is the telephone line, consisting of two No. 8 copper wires, suitably transposed to prevent induction. The insulators used in the power line are of the Locke type, 20,000 volts, composed of brown porcelain.

In the sub-station, situated behind the main machine

shop building, will be installed six air blast transformers of 140 K. W. capacity each, receiving the three-phase current at 6,100 volts and delivering it either two or three phase 575 – 1150 – 2300 volts, as desired. The air pressure is supplied by a direct connected blower set supplied in duplicate. Marble switchboards supplied with fuses and switches arranged to make all possible combinations of transformers and lines will be installed. All the electric apparatus is being made and installed by the Canadian General Electric Company's employees, and when completed will form a model plant in every respect.

THE PRACTICAL SIDE OF THE INCANDESCENT LAMP.*

By Francis W. Willcox.

Mr. Willcox referred to the well-known fact that a high-efficiency lamp is preferable for central station service, for the obvious reason that its use secures a greater capacity of machinery and conductors, and a lower cost of light production. He then considered the actual relative value of the 3.1-watt and the 3.5-watt lamps, taking into consideration the disadvantages of the high efficiency lamp as opposed to the advantages mentioned. The 3.5-watt lamp, he explained, has a useful life of about 800 hours, while the 3.1-watt lamp has a useful life of about 400 hours. It will, therefore, require two high-efficiency lamps to give the same useful lighting service that is rendered by one 3.5-watt lamp. The 3.1-watt lamp saves 6.4 watts in power consumption, so that for a period of 800 hours the total saving would be 5120 watt-hours as compared with a 3.5-watt lamp. This saving must be compared with the cost of an additional lamp. Figuring the price of the lamp at 18 cents, it is evident that the figure per kilowatt-hour at which the two lamps are equal in cost is found by dividing 18 cents by 5.12, which gives a cost of 3½ cents per kilowatt-hour. Below this figure the 3.5-watt lamp shows the lower cost, above it the 3.1-watt lamp is the cheaper. It must be noted, however, that these figures do not cover the value of the increased capacity in apparatus and lines resulting from the use of a higher efficiency lamp.

Besides the mere question of cost, the 3.1-watt lamp has the advantage of compelling timely renewals by burning out just beyond the end of the period of useful life. A large number of lamps tested by the Lamp Testing Bureau were allowed to burn until they broke instead of being taken down when the candle-power had diminshed to 80 per cent. of the rated power. The tests showed that the majority of the breakages occurred in the vicinity of the 500 and 600-hour points. Another feature of advantage in high-efficiency lamps is the better quality of light, its greater brilliancy and whiteness, and consequently more attractive appearance. Candle-power, Mr. Willcox stated, does not completely express the value of an illuminant, as is well known. It affords a satisfactory measure of light for use in reading—in the illumination of black and white, but the power of the light to bring colors increases with the temperature of the filament out of all proportion to the candle-power. Therefore, the high-efficiency lamp has the advantage as an illuminant against a low-efficiency lamp in most branches of modern lighting service, such as the illumination of show windows, stores, picture galleries, etc. With reference to lamp voltages, Mr. Willcox advocated the avoidance of lamps of the so-called standard voltages of 100, 104, 110 and 115, for the reason that the demand for lamps of these voltages is many times the supply and the purchaser therefore serves his own interests best by adopting some uncommon voltage, such as 107, 108, 113, 117, 122, etc.

Referring to high-voltage lamps (of 200 to 250 volts), Mr. Wilcox stated that there are over 500,000 of these lamps annually supplied to consumers in the United States, and that their use is being rapidly extended. Such lamps, however, until very recently have been limited to low efficiency, averaging four watts per candle. At this efficiency they give a useful life about 50 per cent. better than the 100-volt 3.1-watt lamp. They require, however, about 20 per cent. more power in station capacity for the same output in candle-power, and this has been a great drawback to their use. The superior distributing advantages of the 200-volt system and the resulting demand for these lamps have caused strong efforts to improve their efficiency, with the result that 250-volt lamps of an initial efficiency of 3.4 watts per candle for 16-c.p. and 20-c.p. lamps, and 3.1 watts per candle for higher candle-powers are now made to give an average useful life as good as the 100-volt 3.1-watt lamp, that is, about 450 hours.

With regard to candle-power, Mr. Willcox stated that while 16 candle-power still remains the standard of service in this country, there has been in the past

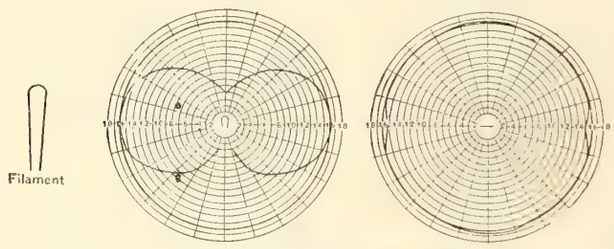


FIG. 1.—SINGLE LOOP FILAMENT.

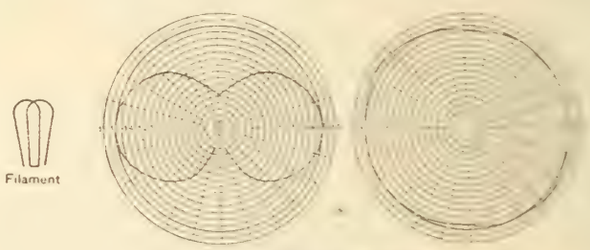


FIG. 2.—DOUBLE LOOP FILAMENT.

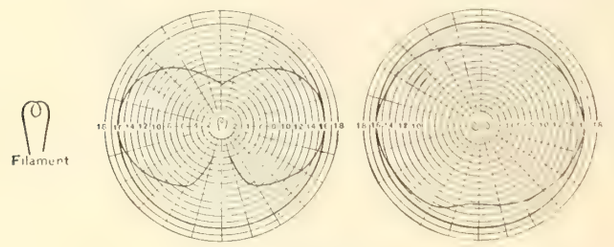


FIG. 3.—SINGLE COIL FILAMENT.

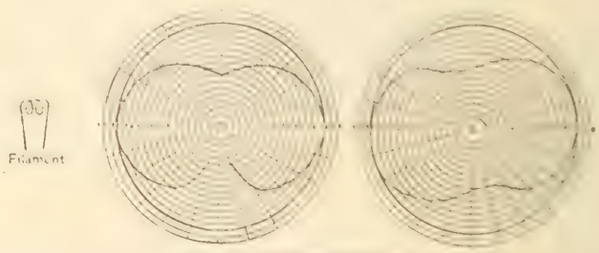


FIG. 4.—DOUBLE COIL FILAMENT.

*Abstract of paper read before the National Electric Light Association, 1901.

few years a large and constantly increasing use of lamps of lower candle-powers, such as 10, 8, 6, 4, and 2. The lower the candle-power of the lamp, for a given efficiency, the more delicate becomes the filament, of course, and for equal results in lite, therefore, lamps of low candle-power must necessarily have lower

TABLE I.—SHOWING USEFUL LIFE OF INCANDESCENT LAMPS.

Watts per candle.	8-c. p.	10-c. p.	16-c. p.
3.1	...	335 hrs.	450 hrs.
3.5	610 hrs	750 "	800 "
4.	1110 "	1650 "	1600 "

efficiencies than lamps of 16 candle-power. Table I herewith shows the average useful life of lamps of different candle-power at various efficiencies. The use

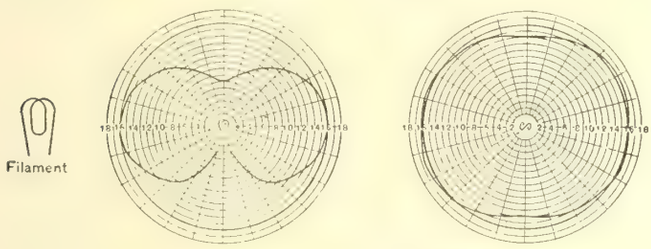


FIG. 5.—OVAL ANCHORED FILAMENT

of the lower candle-power lamps, Mr. Willcox stated, should be more general than it is, and they are to be recommended to all central station managers who desire to increase their business, especially among residences.

Mr. Willcox did not advocate the use of lamps of higher candle-power than 32. With reference to types of filaments, he presented the curves shown in Figs. 1 to 5, which speak for themselves. In each illustration the shape of the filament is shown on the left, the distribution of light in a vertical plane is shown next, and at the right is shown the distribution of light in a horizontal plane, in other words, the distribution below the tip of a lamp hung vertically.

Referring to the candle-hour performance of incandescent lamps, Mr. Wilcox pointed out that tests for candle-hour curves are conclusive only when there are tested a sufficient quantity of lamps of one make to secure a fair average, when the methods of testing are correct, and finally when the duration of the test is sufficient to bring out the qualities of the lamp. One of the details of importance in making such tests is to have the initial efficiency of the lamp accurately determined, certainly within 1/10 watt per candle. Such a difference seems a small one and it might be thought that it can be ignored, but it is sufficient to cause a difference of 100 hours in the performance of lamps of equal quality. The preferable efficiency at which to test lamps is 3.1 watts per candle, as lamps burned at this efficiency will give complete results in about one-half the length of time necessary for lamps burning 3.5 watts. If it is not possible to obtain lamps which correctly measure 3.1 watts per candle, the pressure can be raised at the socket so as to increase the candle-power up to the desired point, or the lamps can all be burned at a common voltage at various efficiencies and the results can afterward be corrected by the application of a correction factor taken from the chart shown by Fig. 6.

The curves in this chart give the changes of voltage, watts per candle and life corresponding to different candle-powers. These curves enable one to make the following comparisons: Given a certain candle-power and life, one can find the candle-power at another life, or the life at another candle-power; with a given candle-power and voltage one can find what the candle-power would be at another certain voltage, or what voltage would be required for another candle-power; given the candle-power and efficiency in watts per candle, one can find what the candle-power would be at another efficiency, or what the efficiency would be at another candle-power; given the voltage and life, one can find what voltage would be required to give some other life, and what life would result by using some other voltage; given the voltage and efficiency, one can find what voltage would be required to give any other definite efficiency, and what the efficiency would be at any other definite voltage; given the efficiency and life, one can find what the efficiency would be at another life, and what the life would be at any other given efficiency.

When the filaments differ in type, equal efficiency in watts per candle by horizontal candle-power measurements does not mean an equal strain on the filaments,

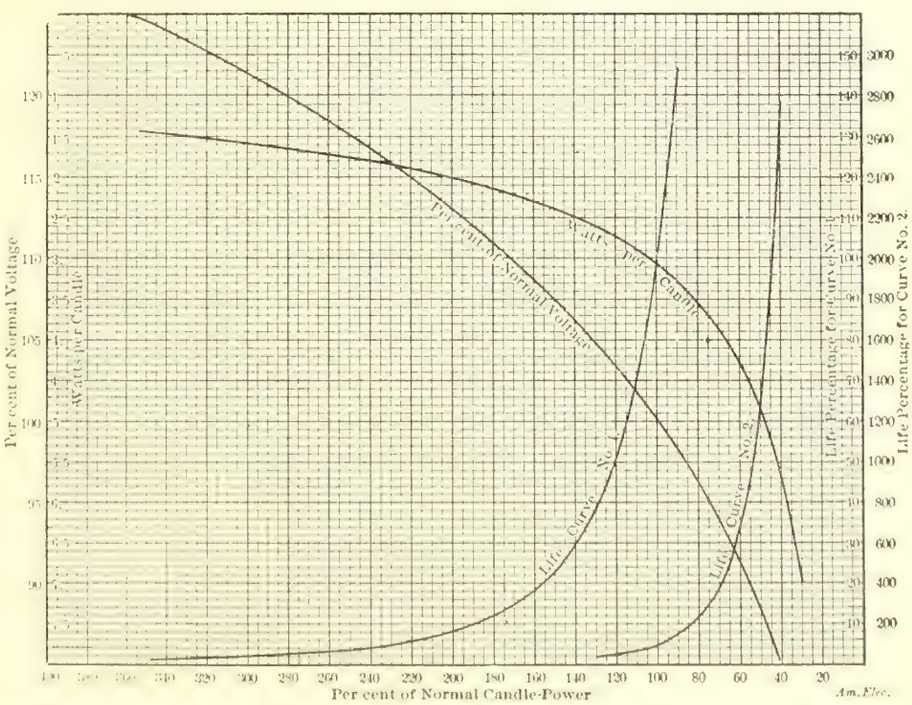


FIG. 6.—CHART SHOWING RELATION BETWEEN VOLTAGE, EFFICIENCY, CANDLE-POWER AND LIFE.

nor form an exact basis of comparison. In such cases it is necessary to consider the total spherical candle-power, and one of two courses may be pursued, namely (1) determine the watts per horizontal candle-power at which the different filaments in comparison with some standard will be on an equal basis of comparison, and set the different filaments up for candle-hour test at these respective efficiencies by horizontal candle-power

measurement ; (2) burn the lamps at an agreed initial efficiency, say 3.1 watts per horizontal candle-power, and then correct the results by the application of a correction factor determined for the different forms of filaments in terms of some standard filament. The accompanying table contains in one column the efficiencies as suggested by the first method, and in the other column the percentage ratios required for the use of the second method.

TABLE II.—TABLE FOR REDUCING RESULTS OBTAINED WITH DIFFERENT TYPES OF FILAMENTS, TO AN EQUAL COMPARATIVE BASIS, TAKING THE OVAL FILAMENT AS A STANDARD.

Type of filaments.	Hor. W. P. C. at which to test lamps of various type filaments in order to burn them at the same temperature as oval filaments at 3.1 Hor. W. P. C.	Factor by which to multiply effective life of various type filament lamps burned at 3.1 Hor. W. P. C. in order to equate them with oval filaments burned at 3.1 Hor. W. P. C.
Oval	3.10	1.00
Single spiral	3.10	1.00
Double spiral	3.12	1.03
Single loop	3.02	.855
Double loop	3.025	.865

Mr. Willcox closed his paper by urging the use of free lamp renewals on the part of central stations, and argued very forcibly against allowing consumers to buy their lamps where and how they pleased. He described the method in vogue at the New Haven (Conn.) central station where the lamps in the business section are taken off the circuits and replaced with fresh lamps four times a year. The lamps brought into the station are cleaned by means of a small buffing lathe and photometered, or rather passed through a photometer, in order to ascertain whether they are above or below the "smashing" point.

THOMSON RECORDING WATTMETER.*

By C. G. Carmichael.

While comparisons between the meter and contract systems are no longer necessary, the choice of a meter is an important consideration : Shall it be an ampere meter registering the current, or a wattmeter registering the energy? To answer this let us examine effects of voltage on a 16 candle power, 3.1 watt incandescent lamp. A variation in voltage of 2% from normal is quite common, but the 2% variation given in Table 1 is sufficient for our purpose.

Table 1.—Effects of voltage on a 16 c. p., 3.1 watt incandescent lamp. Normal voltage 100.

Volts.	Candle p'w'r	Watts per Candle	Amperes	Total Watts
98	14·40	3·33	0·485	47·5
99	15.20	3·21	0·492	48·8
100	16·00	3·10	0·496	49·6
101	16·96	3·00	0·504	50·8
102	17·92	2·91	0·512	52·2

Suppose the electric light company is able to dispose of its power at the low rate of 10 cents per kilowatt hour. From Table 1 we see that a 16 c. p., 3.1 watt lamp at normal voltage takes 0.496 amperes. Since an ampere meter is calibrated from an indicating wattmeter, the voltage being kept constant at normal, for this case a rate of 10 cents per k. w. h. is same as 1 cent per ampere hour. Also here a rate of 10 cents per k. w. h. is same as 0.031 cents per candle power hour.

We can now deduce the following table of charges per lamp hour, according to above three methods.

Table 2.—Charge per lamp hour.

Voltage	Charge per lamp hour at 10 cents per K. W. H.	Charge per lamp hour at 1c. per ampere hour.	Charge per lamp hour at 0·031c. per candle pow'r hour.
98	0·4751c.	0·485c.	0·4464c.
99	0·4880	0·492	0·4712
100	0·4960	0·496	0·4960
101	0·0588	0·504	0·5258
102	0·5220	0·512	0·5555

It can thus be seen that when voltage is below normal the ampere meter records more power than is used, and when voltage is above normal this same meter records less power than is actually consumed. Apparently it might therefore be argued that it would pay to use ampere meters and keep the voltage low. But any electric light company could soon tell you how many customers it would have at the end of a year were it to supply only 14 c. p. and charge for 16 c. p.

Now consider the customer. He wants so much light. Virtually he wants to pay so much per candle power hour. Say he is a merchant and in a year he uses 200 sixteen candle power lamps for 500 hours or 100,000 lamp hours. From Table 2 his lighting bill is found.

For a voltage of 98—

By Wattmeter his bill would be.....$475.10
By Ampere Meter his bill would be..... 485.00
His just bill at 0·031 cents per c. p. hour is . 446.40

That is, Ampere Meter charges him too much by $38.60, and Wattmeter too much by $28.70, that is, Wattmeter is more nearly correct by $9.90.

For a voltage of 102—

By Wattmeter his bill would be.....$522.00
By Ampere Meter his bill would be..... 512.00
And his just bill at 0.031 cts. per c. p. hour is 555.50

That is, by registration of current the merchant is charged too little by $43.50, and by registration of energy too little by $33.50, again showing a difference of $10.00 in favour of the Wattmeter.

The first requirment essential to a perfect recording meter is therefore registration of energy and not current, one of its factors. A meter must be simple and durable ; able to resist tampering and independent of atmospheric conditions ; independent of frequency and inductive circuits and must be adaptable to either direct or alternating current.

I will attempt a brief description of the Thomson Recording Wattmeter. In fig. 1 is shown a 5 ampere, 220 volt meter, the connections being shown in fig. 2. It is simply a small motor and dynamo combined. A small fraction of the energy which the meter measures operates the motor, and the retardation is supplied by the light drag of a copper disk rotating between the poles of two magnets.

*Paper read before the Engineering Society of the School of Practical Science, Toronto. Published by permission.

The armature consists of a number of coils of fine wire wound upon a frame of pressed paper, which is fastened to the vertical shaft. The commutator bars are made of silver and the brushes are tipped with that metal. The armature, in series with a suitable resistance and the shunt, is connected across the line. The fields consist of a number of turns of stout copper wire of size sufficient to carry a current of twice the rated capacity of the meter. These fields are connected in series with one side of the line, the full current passing through them. Hence the torque of the motor is exactly proportional to the watts.

There is no iron about the motor, and the meter when once calibrated is adaptable to either direct or alternating current. In fact were we to replace the brushes by two connections affixed to opposite segments in the commutator and attach a suitable spring and pointer to the shaft, we would have an indicating wattmeter capable of being used on any circuit.

The copper disk rotates between the poles of two magnets. By moving the magnets out or in the speed is regulated so that the number of revolutions of the disk in a certain time corresponds to energy delivered to the circuit in that time. On the shaft is a worm which operates the recording mechanism.

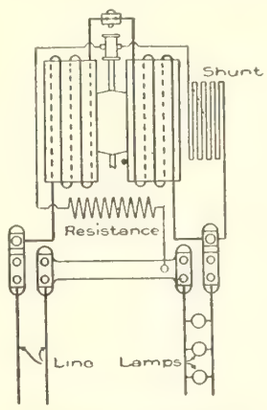
As before stated the shunt is connected in series with the armature and resistance across the line. It consists of a suitable number of turns of fine wire and is inserted in the inside of one of the field coils. Its object is to assist meter on light loads, thus giving the meter great accuracy on all loads.

In the lower end of the shaft is a polished, hardened steel detachable pivot. The shaft sits on a jewel mounted on a spring in the end of a screw. So that if from any cause jewel or pivot should be damaged both can be easily removed and replaced by new ones without removing the cover. The meter is protected by a metallic cover which is drawn tightly down on to a strip of felt on the base, thus rendering it dust proof. To the underside of the base is fastened a metallic plate. When itis sealed up itis impossible to tamper with the meter without breaking the seals.

Wattmeters are tested by connecting them up with an indicating Wattmeter ; and with a stop watch noting the time of a certain number of revolutions of the disk. The formula,

$$\frac{3{,}600 \times \text{constant} \times \text{number of revolutions}}{\text{time (in seconds.)}}$$

gives watts recorded by the recording meter and this should agree with the reading of the indicating watt-



Two wire, up to 50 amp

FIG. 2.

meter. If there is not a close enough agreement the magnets are moved out or in, according as meter is fast or slow.

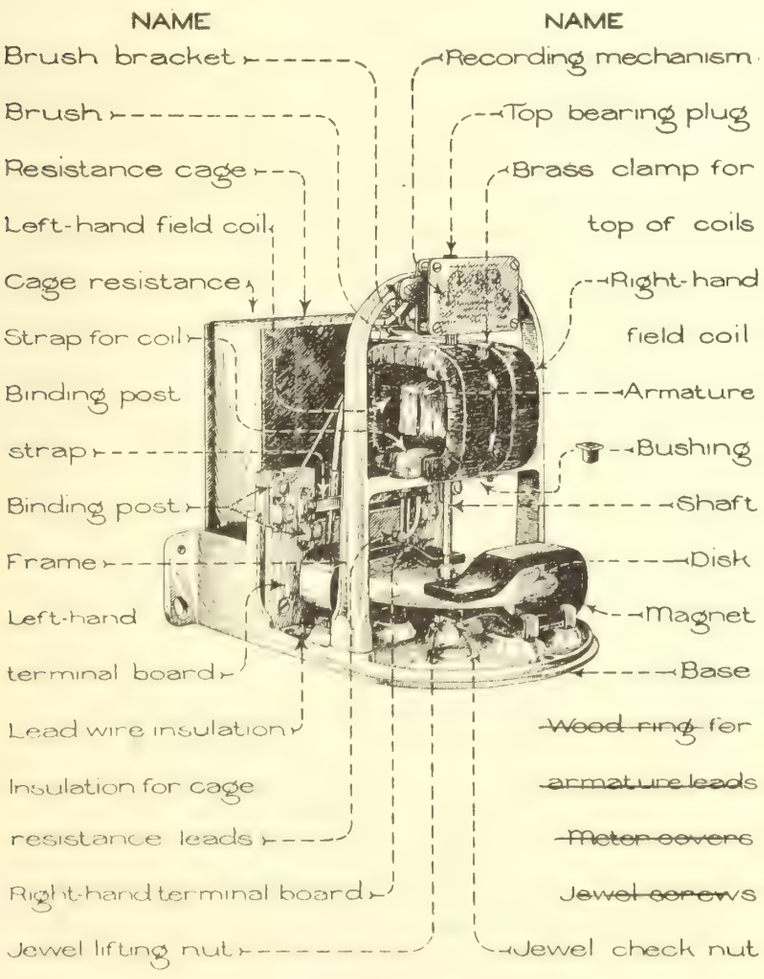
The formula is derived as follows :

Let 1 revolution of disk in one hour = 1 watt hour.

Hence 1 revolution of disk in 1 sec. = 3,600 watt hrs.

Or N revolutions of disk in 1 sec. = 3,600 × N watt hrs.

Or N revolutions of disk in t sec. = $\frac{3{,}600 \times N}{t}$ watt hrs.



Now suppose we took a 25 amp., 100 volt meter and passed 100 amperes at 100 volts through it, the disk would rotate at the abnormal speed of 166.68 r.p.m. If the field coils were made with one-quarter of the number of turns of wire the torque, and hence the speed of the disk, would be one-quarter of what they were before. Since the disk is running at one-quarter of the speed necessary to record the power in the circuit, the dial will indicate only one-quarter of the power, so the dial reading is muntiplied by 4, or as it is termed "constant 4." The formula becomes

$$\frac{3{,}600 \times \text{constant} \times \text{number of revolutions}}{\text{time (in seconds)}}.$$

Another way of looking at it is—

Let W = watt hours.

N = number of revolutions.

t = time in seconds.

K = constant.

$$W = 3{,}000\frac{N}{t}$$

W Relovutions per hour.

$$W \quad K\frac{3{,}000N}{t}$$

By choosing the proper value for $\frac{3{,}600N}{t}$ we can have any value of K, ½, 1, 2, etc., depending on the size of the meter.

Everything should be carefully considered before selecting the proper size of wattmeter to be used. If a building is to be illuminated with 400 lamps it does not of necessity follow that a 400 light meter will do.

When a meter is set up it should be examined annually by a competent person. Don't suppose that it is going to run forever after it has first been inspected and then sealed up.

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Automatic Telephone Systems.

THE important announcement is made that the German government has purchased the exclusive rights to the Strowger automatic telephone patents, and the system will be installed in Berlin and other cities throughout the German Empire. This purchase has been made as the result of a report upon the system by A. Feyerabend, head of the German telephone and telegraph system. The Strowger Company, of Chicago, from whom the rights to manufacture and use the system were purchased, had an experimental automatic exchange of two hundred instruments working for upwards of a year in the government offices in Berlin. The result of the more extended operation of the system will be watched with much interest.

The Telephone.

SUBSTANTIAL progress is constantly taking place in the telephone field, although we do not perhaps hear so much about it as of the developments in the application of electricity to the production of light and power. One of the latest uses to which the telephone has been applied, is the despatching of trains on steam railways, a field in which the telegraph has until recently been exclusively employed. The Delaware, Lackawanna and Western Railroad, operating a system of lines between New York and Buffalo, has announced its intention to adopt the telephone instead of the telegraph for despatching purposes on its main lines. The Erie Railway is said to have used the telephone in this connection with satisfactory results. The Albany and Hudson Railway also uses the telephone extensively for despatching purposes. The advantages claimed for it are, greater speed and less expense in delivery of despatches. It is claimed that the use of the telephone as compared with the telegraph does not increase the number of mistakes.

Capital and Labor.

THE great combinations of capital and the aggressiveness of the unions of workmen in the United States, is bringing to a focus sooner than was expected the settlement of the relations that shall in future prevail between employer and employee. The most gigantic strike in history is now in progress between the steel workers and what is known as the United States Steel Trust. The employers are said to be losing a third of a million dollars per day, and the employees about half that sum. Upon the outcome of this great struggle will largely depend the conditions which are to govern, at least for a time, the relations of the combatants in the future. It seems impossible at present to forsee what the ultimate and permanent solution of the difficulty will be. It would seem, however, that there must either come a better understanding between employers and employees, by which regard will be shown for the interests of both, or the government must step in and compel the settlement of disputes by arbitration. In New South Wales, a compulsory arbitration law now prevails, and is said to be working satisfactorily. In Canada we have what are called Conciliation Laws, which provide means for the adjustment of disputes where both parties are willing to submit their case to arbitration. These laws appear to be a dead letter. The statement is made that in the present strike of trackmen on the C.P.R., which is a hindrance to public traffic, no request for arbitration has been made by either of the parties to the dispute

If the law is to be invoked, it must, to be of any service, be compulsory. It is most unfortunate that these disputes regarding wages and hours of labors should be allowed to block the wheels of industry in prosperous times, and hasten the return of commercial depression.

An Important Judgment

The judgment rendered by Mr. Justice Andrews in the Superior Court of Quebec, in the action brought by the Quebec Railway, Light and Power Co., against the Jacques Cartier Water Power Co., printed in full in this number, is of the greatest importance to electrical companies as well as to municipalities and users of electric light and power. The plaintiffs claimed damage to their property and business from the defendants' poles and wires, and asked the courts to compel their removal. The judgment is in favor of the plaintiffs' and is based on the principle that the plaintiffs having been first established, the second company is not entitled to cross their wires at any place or height. Confirmation of this principle would seriously affect the majority of electrical companies throughout Canada and the United States, where the universal practice has been for the companies to cross each others' wires. As long as the overhead system is used, it would seem as though the crossing of wires could not be entirely avoided. The effect of Judge Andrews' decision, if sustained, would be to cause endless trouble and expense to the electrical companies, create monopolies, and retard the progress and benefits of electricity. An appeal will be taken from the judgment, and we shall be greatly surprised if it is not reversed by the Court of Appeal or the Privy Council.

The Canadian Electrical Association

It is to be hoped that the instructors in the electrical departments of our Canadian Scientific Schools will urge upon their students the desirability of becoming student members of the Association under the provisions of the amended constitution adopted at the recent Ottawa convention. The cost of student-membership is only one dollar per year. The advantages of acquaintanceship and association with the men who are actively connected with the commercial applications of electricity, should be worth a much larger sum to the student. Having decided to cultivate closer relations with the young men who are fitting themselves for a place in the ranks of the electrical workers in the future, the Association might consider the advisability of establishing for the benefit of its members a carefully selected technical library. It having been decided that no funds of the Association shall hereafter be used for entertainment, a sum of one hundred to one hundred and fifty dollars per year hitherto expended in this direction, will in future be available for other purposes. Why not use this money, or a portion of it, to purchase books for a circulating library? Each member of the Association might be given the use for a limited period of such books as he might desire, charge being only made for postage, neglect to return books promptly, or any damage to books while in the borrower's possession. Technical books are necessarily expensive, and only the few can afford to own a well-appointed library. Hence the probability that if one were established by the Association, it would meet a well defined need of present members, as well as of many persons outside, who might thereby be induced to connect themselves with the organization.

To Station Managers and Engineers.

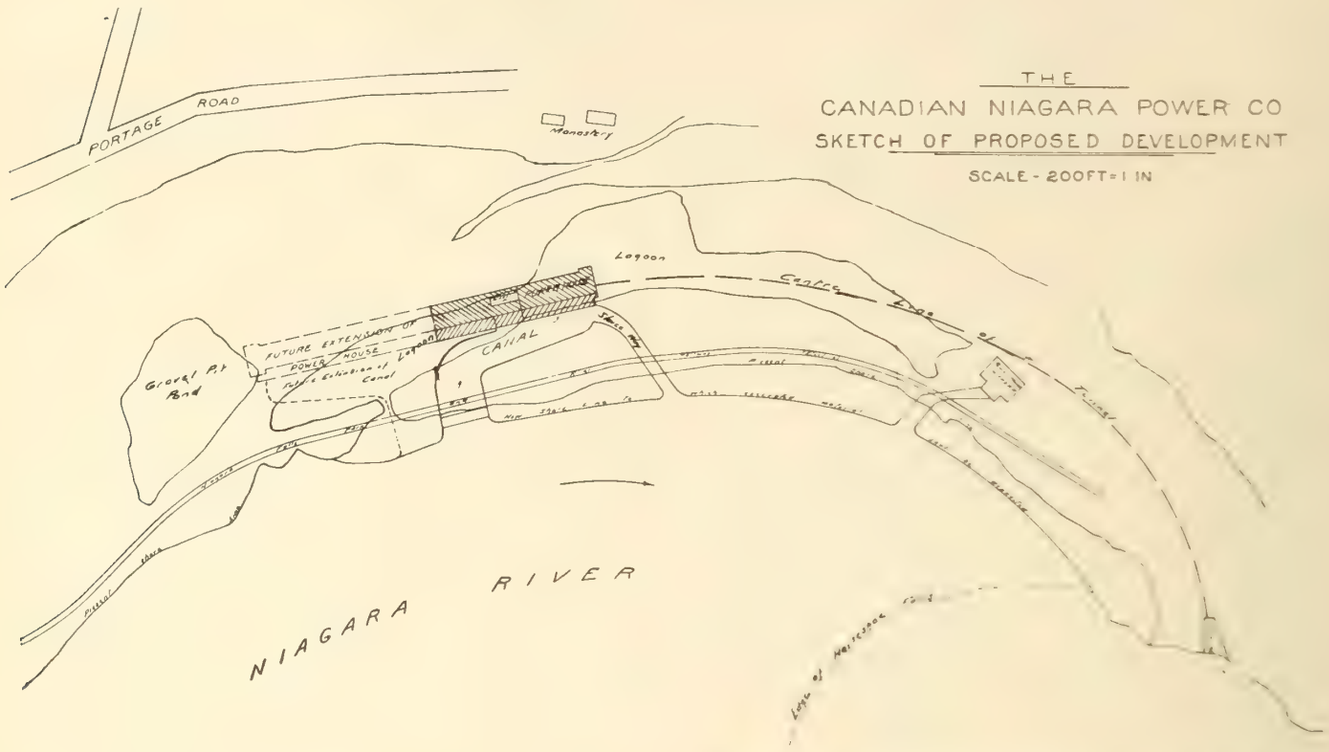
Mr. Station Master or Engineer, your attention, please! In the performance of your many duties during the 365 days of every year, do you not sometimes as the saying goes, "strike a snag"—find yourself face to face with a difficulty which you have never encountered before? In such an event, what do you do—wrestle with the problem until you have solved it, or get somebody with more experience to help you out? A Department of Questions and Answers has been established in this journal, to assist in the solution of such problems as are likely at any time to confront sation managers and engineers. It is at your service, either to obtain or impart information. If some unusual experience has come to you, tell us about it, and how you managed to get over the difficulty. Such information is certain to prove valuable to somebody in a similar situation. If you have a difficulty which you don't know how to deal with, or desire information which is not readily obtainable, drop us a line stating what is required, and somebody with the requisite knowledge will no doubt be willing to help you. In sending in questions, or answers to those of some one else, it is not necessary that your name should appear in print, but name and address should be supplied the editor for his information, and as a guarantee of your bona-fides.

Decadence of the Exhibition.

In point of attendance the Pan-American Exhibition at Buffalo has thus far proved a failure. The holiday season, during which the largest attendance might reasonably be looked for, will soon have passed, yet the expected thousands have not put in an appearance, and in consequence it is rumored that the Exhibition may close at an earlier date than was intended. The fact is apparent that the Exhibition business has been overdone. The original idea of these large Exhibitions was to bring together the most improved devices and methods in manufacturing, as well as specimens of the natural products of the nations of the earth. So long as this was the prominent feature, and an interval of at least ten years was allowed between the Exhibitions, they were reasonably successful. In recent years, however, projects of this kind have become too numerous, while their educational value has seriously declined. The Exhibition of to-day is a huge bazaar and circus combined, depending for success not upon its ability to instruct, but to amuse and excite wonder. It is not surprising that agriculturists, inventors, manufacturers and artisans no longer think it worth the cost to exhibit, or the earnest worker in any department to travel long distances to visit modern shows. The city of St. Louis, where arrangements have been in progress for a year or more for an Exhibition on a large scale next year, has wisely taken warning by the failure at Buffalo, and postponed the event for at least three years. It is perfectly safe to assume that if with all its advantages of situtaion, the Buffalo project has failed, St. Louis could not succeed in inducing northerners at least to exchange the cool breezes at the seaside, or by the great lakes, for her stifling atmosphere. She would do well to substitute for her proposed Exhibition a winter carnival. Canada's resources have only recently reached the point which would justify her in attempting to inaugurate a Dominion Exhibition. In view of the evident decline in public favor of such enterprises, the wisdom of embarking thereon now seems open to question.

POWER DEVELOPMENT AT NIAGARA FALLS.

The accompanying map will give our readers a fair understanding of the location of the proposed development work about to be carried out on the Canadian side of Niagara Falls by the Canadian Niagara Power Company. The work is now in progress, the contract being in the hands of A. C. Douglas, who has had considerable experience with excavations connected with the power development on the New York side at the Falls. Mr. Cecil B. Smith, Ma. E., of Toronto, has been appointed resident engineer.



The company have agreed with the Ontario Government to expend on these works within two years a million and a half dollars. Arrangements have been made for the complete construction of the first installation of the company, comprising a tunnel of 100,000 horse-power capacity, an inlet canal, and a wheel-pit of 50,000 horse-power capacity, together with the installation of electrical and hydraulic machinery to develop 25,000 horse-power.



Sinking the First Shaft Canadian Niagara Power Company's Works.

The wheel-pit for the first section will be about 250 feet long, while its depth will be approximatey, 200 feet. The tunnel that will serve as a tail race will be built in the form of a horseshoe, similar to the tunnel on the New York side, but the section will be somewhat larger. In length the tunnel will be about 2,200 feet, its portal being at the foot of the Horseshoe Fall. The length of the tunnel on the New York side is over 7,000 feet. From this it will be seen that the development on the Canadian side will require the construction of a tunnel of only about one-third the length of the tunnel on the New York side, greatly lessening the cost of development. The minimum capacity of the tunnel will be 100,000 horse-power. The Canadian wheel-pit and tunnel will be lined with brick throughout, the same as the pit and tunnel on the opposite side of the river.

The second illustration shows the sinking of the first shaft.

THE ALMONTE ARBITRATION.

The arbitration case between the town of Almonte and the Almonte Electric Light Company, to determine the value of the plant of the latter, has been concluded. The action was the result of an offer made under the Connee Act by the town of Almonte to purchase the plant of the Almonte Electric Light Company for $10,000. This amount was refused by the company, who asked $18,000. The board of arbitrators was composed of Judge McTavish, of Ottawa, Judge Liddell, of Cornwall, and J. H. Barrett, of Pembroke. A great deal of expert evidence was taken, but it is said that the proceedings were carried on in a most harmonious manner. The award of the arbitrators fixed the value of the plant at $14,750 and directed the town to pay the cost of the arbitration in any event. Thus the award is $4,750 more than the town offered, and $2,250 less than was asked by the company.

AN IMPORTANT LEGAL DECISION AFFECTING THE RIGHTS OF ELECTRICAL COMPANIES.

QUEBEC RAILWAY LIGHT AND POWER CO., VS. THE JACQUES CARTIER POWRR CO.

The following important judgment in this case was given by Mr. Justice Andrews in the Superior Court, at Quebec, on June 15th last:—Whereas the plaintiffs and defendants being engaged in the same kind of business, viz., the furnishing of electric light and power in, and in the neighborhood of, the city of Quebec, the plaintiffs also owning and operating an electric railway there, the plaintiffs on the first ground complain that the defendants, by their works, poles, and wires, are obstructing and endangering the business, plant and property of them, the said plaintiffs, and over that the defendants have no right to carry on their business or occupy the roads or streets of the city.

Whereas the defendants by their own plea deny that they obstruct, or in any wise injure, the plaintiffs' averring that they, the said defendants, are acting within their charter rights, and retort that the plaintiffs are without such rights.

Whereas after proof and hearing on the merits the Court, to wit: on the 9th June, 1900, by interlocutory judgment, ordered that by three sworn experts, certain matters and facts in contest between the parties should be examined and verified; and in conformity with such interlocutory order three experts were duly named and appointed and have duly fyled their report; which report the plaintiffs have moved to homolgate in part, and the defendants have moved to reject; and the parties have again been heard by their counsel, as well on the said motions as on the merits of the case, as affected by said report ;

Considering that both the plaintiffs and the defendants have established their charter-right to carry on their business in the city and district of Quebec ;

Considering that the plaintiffs had duly established their plant, poles, wires and business in the said city and district of Quebec before the defendants had begun the construction of their works ; part of the plaintiff's said business being the lighting of the city streets and public places ;

Considering that the plaintiffs, where they were in occupancy of streets or public places in the city of Quebec, or of portions thereof, with their said poles and wires prior to the advent thereto of the said defendants, have rights resultant from such occupation, which, though not exclusive rights, entitle them to protection and to being maintained in such possession or occupancy as is reasonable ;

Considering it is established that the defendants have so constructed their line that it, at certain points, constitutes an illegal interference with the plaintiff's said line, or system, and with their said business; and that the dangers, detriments and injuries thereto thereby occasioned justify the plaintiffs in asking rèdress from this court ;

Considering that the suggestions of the said experts for the diminishing of the dangers involves such an interference with the property, poles, wires and appliances of the plaintiffs as renders such suggestions impossible of adjustion, and that their adjustion would not be just to the plaintiffs, nor in all cases protect them from danger and detriment ;

Considering that the plaintiffs have established by the said report of said experts, and by the other evidence of record, that the poles and wires of the said defendants are in dangerous proximity with those of the said plaintiffs, at all the points complained of in the plaintiff's declaration, except the intersections of said wires at Acqueduct and Massue streets, Crown street, opposite Merchant's Club, McMahon and D'Auteuil streets, Angele and Elgin streets, and Ursule and St. Louis streets ;

Considering that the motion of the said defendants for the rejection of the said reports of said experts is irregularly made, and is also on its merits inadmissible, and unfounded : the said motion is rejected with costs : and it is hereby adjudged and ordered that the said defendants do, within three months upon the service upon them of the present judgment, remove all the wires, poles and other constructions, so as aforesaid in dangerous proximity with those of the said plaintiffs, to wit, at the intersections of the following streets in the city of Quebec, viz.: of St. Francis and St. Dominick, St. Francis and Grant, St. Francis and Bridge, St. Francis and Crown, Jacques Cartier and St. Francis, St. Francis and Dorchester, St. Francis and Caron, St. Francis and St. Anselme, St. Francis and Boulevard Langelier, Church and Prince Edward, Church and Queen, Church and Richardson, Church and King, Church and Helene, St. Anselme and St. Joseph, St. Valier and Turgeon, Colombe and near Boulevard Langelier, Francis and Boulevard Langelier, Bedard west of Boulevard Langelier, Bedard opposite No. 42, Bedard and dela Violette, Bedard opposite No. 75, Bedard and Parent, Avenue, Bedard and Carillon, Valier street near Canadian Pacific Railway, Valier street near toll-gate, Montmagny and Dollard, Dollard and St. Sauveur, Dollard and St. Luc, Dollard and Germain, Dollard and Bayard, Dollard and Darocher, Chenier and Duquesne, Valier and Massuè, Sauvageau opposite Nos. 9 and 17, Sauvageau and Bagot, Sauvageau and Morin, Sauvageau and Hermine, Sauvageau, opposite No. 102, Sauvageau and Kirouac, Aqueduct and Montcalm, Aqueduct and Boisseau, Aqueduct and Morin, Aqueduct and St. Luc, Colombe and St. Germain, Colombe and Bayard, Colombe and Durocher, Colombe and Victoria, Colombe and Sauvageau, Colombe, near Sauvageau, Demers and St. Jude, St. Valier and St. Jude, Boulevard Langelier and Notre Dame, Notre Dame and St. Anselme, Notre Dame and Caron, Notre Dame and Dorchester, Notre Dame opposite Nos. 11, 25 and 31, Notre Dame and Crown, Desfosses and Church, Bridge and Grant, Dominick and St. Rochs, St. Paul and Haymarket, Arago and Belleau, Arago and Valier, Valier and Cote d'Abraham, Cote d'Abraham and Richelieu, Eustache and Richelieu, Glacis and Richelieu, McMahon and St. Angele, John and Dauphine, Dauphine and Ursule, Dauphine and d'Auteuil, d'Auteuil and Anne, Patrick and Eustache, Patrick and St. Augustin, Simon, D'Artigny, Ste. Genevieve, Lachevrotiere, Jupiter and Drolet, Scott, Palais and Valier, Lacroix and Paul, Ancien Chantier, St. Charles, Dambourges Hill, Sous le Cap, Sault au Matelot, St. James, Bell's Lane, St. James and Dalhousie, St. Paul and Bell's Lane, St. Antoine and Dalhousie, St. Antoine and St. Peter, Notre Dame Square, LePlace opposite Blanchard's, Notre Dame and Sous le Fort, Cul.de-Sac, Champlain, Sous le Fort and St. Peter, Amable and Conroy, D'Artigny, St. Michael and Scott, Lansdowne avenue and Grande Allee, Berthelot and Grande Allee, Julia and Michael, Julia and D'Artigny, St. Augustin and Julia, St. Augustin and St. Patrick, and in default of said defendants complying with this judgment within said time, the said plaintiffs are hereby authorized to have removed all the said poles and wires at the cost and expense of the said defendants ; and the defendants are condemned to pay to the said plaintiffs their costs, reserving to the plaintiffs their recourse for damages.

INSULATION RESISTANCE OF WIREMEN'S GLOVES.

A recent number of the "Bulletin de la Société Internationale des Electriciens" contains a paper read by Janet before the Société in Paris, in which the author gives an account of laboratory experiments performed by him in order to find the insulation resistance of different types of gloves for wiremen. The experiments were performed first with the gloves dry and then with them wet, the pressure being 105 volts in each case. In the dry test the gloves were filled with mercury and then suspended in basin of mercury ; fine sand moistened with acidulated water was used. The resistance in megohms ranged from zero to 52,500 dry and from zero to 420 wet. The author also made wet tests for determining the effective e.m.f. at which the gloves broke down under high-pressure alternating currents. Three of the samples broke down at low voltage, while three others broke down at 1,000, 2,000 and 11,000 volts respectively. In the discussion which followed the reading of the paper it was argued that insulating gloves cannot generally be regarded as an effective protection ; and that wiremen with gloves should not touch the conductors directly, but only such parts as are already insulated.

SYSTEM AND EFFICIENCY OF ELECTRIC TRANSMISSION IN FACTORIES AND MILLS.*

By William S. Aldrich.

The recent progress in the use of electricity for the transmission of power over short distances has developed a new industry. It bids fair to rival in magnitude and usefulness the field of long-distance transmission, much earlier developed, and now almost exclusively held by electricity. As applied to factories and mills electricity is simply a means to an end, which is primarily the transmission of power over quite short distances, from 50 to 500 feet, and within one building or a group of buildings. Upon entering this new field it has had to contest every inch of its progress in competition with long-established usage, in order to displace the unwieldly and unsightly power transmissions by shafting, belting, and rope drives. In almost all cases of new manufacturing plants, however, the features of electric transmission have received thorough consideration, resulting in many factory installations in which this system is exclusively used.

Some manufacturers have hoped that electricity would solve all of the problems, and at once, upon its introduction into their establishments; others have known it would be of no use from the beginning. There are many factories and mills in which the introduction of electricity for power transmission will not pay, under existing conditions; there are more establishments in which it would pay, in which an investment in electric transmission would prove to be a dividend-paying investment. No general rules can be laid down. Each case must be carefully examined, and a most thorough preliminary survey made of all the conditions and requirements.

SYSTEMS OF ELECTRIC DISTRIBUTION FOR FACTORIES.

In choosing a system of electric transmission for manufacturing work, it is not necessarily best to have that one system which will the most readily lend itself to all of the work to be performed, for light, heat and power service. A composite system may prove best suited, even in such short-distance transmission. That is, lighting service will, in general, be more satisfactory, and need not be more expensive, if supplied independently of the power service. Direct and alternating currents are equally adapted for factory transmission, and by simple or multi-circuit systems of distribution; that is, by two, three, or four-wire systems, as the case may require. Preferably, all distribution should be direct; that is, without the use of storage batteries, rotary converters, or transformers, except for certain lines of work in which it may be necessary to use one or the other of these indirect systems of distribution.

In the matter of voltages a wide range is possible: 110-volt two-wire and 220-volt three-wire systems for use of either direct or alternating currents for light and power; 440-volt two-phase alternating current three or four-wire systems for both light and power; 550-volt direct-current two-wire system, or 550-volt alternating current three-phase three-wire system, chiefly for power service, or the monocyclic system for both light and power. In general, it will not be necessary or advisable to use over 550 volts, direct or alternating current. Shocks arising from accidental contact with wires carrying currents of this voltage are not necessarily dangerous. Experience has shown that workmen respect the distributing wires the higher the voltage. But it is not necessary to command such respect by raising it above 550 volts.

ELECTRIC TRANSMISSION BY DIRECT CURRENTS.

At the time that electricity was introduced into manufacturing establishments the direct-current system was the only one available. For the peculiar and exacting service required in driving all kinds of machine tools and various workshop appliances, there were difficulties to be overcome with any system. It was necessary to secure satisfactory methods of producing a large starting turning moment, or torque, for varying the speeds as might be required under uniform or variable loads, and for reducing to a minimum the trouble arising from the use of a commutator.

With direct current motors, it was a simple matter to introduce starting boxes (resistances) in the armature circuit to control the torque, as well as rheostats (resistances) in the fields to control the speed in particular. But every such resistance meant an expenditure of energy in otherwise useless heating of the wire or other material of which these resistances might be made. The so-called Ward Leonard system came to the rescue with its two additional machines in order to operate the one given machine as a motor, at practically a constant efficiency under all conditions of load and speed. This system has been very successfully and extensively used in elevators, cranes, etc. By the use of the auxiliary machines the supply voltage may be varied according to the speed desired, and the current supplied according to the torque required, without wasting any energy in heating wasteful resistances. For conditions of factory service permitting of such an application, two motors may be advantageously used on one machine or set of machines, by means of which it is possible to vary the torque and speed quite as satisfactorily as in street car working, by the series-parallel method of control.

The difficulties with commutators have been almost entirely overcome and many refinements in design effected, so that the direct-current motor of to-day leaves little to be desired. Such objectionable features as still remain are inherent in the direct-current system used, and are found to lie chiefly in the kind of armature, commutator and brush devices required. These parts are most liable to derangement, require systematic attention for cleanliness and efficiency and renewals of brushes.

ELECTRIC TRANSMISSION BY ALTERNATING CURRENTS—INDUCTION MOTORS.

The alternating current system, with its induction motor service, offered practically the only alternative to those engineers and manufacturers who did not care to be troubled with the petty annoyances and delays likely to occur at any time with the direct-current motor. The induction machine as it stands to-day is probably the most perfect motor yet developed from the standpoint of electric transmission in factories and mills. It may be started and operated from any point at any time, at practically any load and speed within its predetermined ranges. It may be used on 110, 220, 440 or 550-volt alternating current circuits of one, two or three phases. It does not require any direct-current supply as the synchronous motor does for its field excitation. It does not require any

*Abstract of a paper read at the Cincinnati meeting of the American Scciety of Mechanical Engineers.

brushes, commutator or collecting rings. Offsetting these advantages, however, are certain restrictions. The speed of an induction motor falls off slightly as the load is increased. The ability to start an induction motor from rest under a heavy load, as well as the possible speed changes during its operation, are obtained at some sacrifice of efficiency.

Induction motors, moreover, permit of higher lineal speeds than are possible with any other type, from 6,000 to 7,000 feet not being infrequent. By suitable arrangements of its field windings, this type of motor may have its speed altered in regular steps, so reducing it one-half, one-quarter, one-eighth, etc. This makes possible similar changes to gear-wheel combinations, which may therefore be eliminated to the extent that the induction motor is installed to effect such changes. In almost all cases of shop driving, the slip is not objectionable, any more than the increasing slip of the driving belt as the load is thrown on. These motors will stand almost any amount of rough usage and heavy overloads, as they cannot be burned out. If excessively overloaded, the motor slows down and stops, starting up immediately as soon as the load is lightened. Ordinarily, machine tools and almost all classes of shop machinery are started at quite light loads, and the full load is thrown on when the work or the tool is up to the speed desired. For this class of work the induction motor seems specially fitted.

A larger generating power plant is required for an installation of induction motors than would be the case if direct-current motors were used. This is on account of the energy which is lost in all classes of alternating current circuits in which there is considerable self-induction, whether in the transmission wires or in the appliances used. In the case of induction motors this loss is very appreciable at light loads, becoming much reduced at average and heavy loads, at which it is almost uniform.

SYNCHRONOUS MOTORS.

Synchronous motors are admirably adapted to factory service where absolute uniformity of speed is required, and where the extra installation of a direct current supply for their field excitation is not deemed objectionable. While induction motors are always wasteful of some energy, through their high self-induction, synchronous motors may on the other hand be brought into that condition of operation practically equivalent to the use of direct-current motors, at least for a large range of their loads. In other words, the power factor of a synchronous motor may be made almost anything from zero to unity, according to the extent of excitation of its fields by the direct current applied for this purpose.

When made in the revolving field type, synchronous motors are self-starting from rest at light loads. They may be very heavily over-loaded, without falling out of synchronism or out of step, and when they do for an instant they may be brought back again by throwing off some of the load. A well-designed synchronous motor will carry at least three times its full normal load, and not drop out of step. If an induction motor is built for such over-loads it is likely to have quite low efficiency at ordinary loads.

Higher efficiencies may be obtained with synchronous motors than with induction motors of the same output. In fact, such motors realize the ideal conditions of motor working in which the motor attains almost the same efficiency as the generator. Both induction and synchronous motors have usually higher efficiences than direct current motors of same size.

COMBINED INDUCTION AND SYNCHRONOUS MOTOR WORKING.

The ideal conditions in a factory installation no doubt would be secured where both induction and synchronous motors were used, the former for small machines and direct driving, the latter for operating a set or group of machines. The synchronous motors would be started up just before beginning the work of the day, have at all times a light constant load, and might easily be regulated as to produce an almost balanced system in combination with the induction motors. In such a system of transmission the lagging currents of the induction motors would be offset by the leading currents of the synchronous motors, if the latter were operated to produce such leading currents. The whole system would be operated practically throughout quite a range of load variations, as it it were a simple direct current system, the advantage of such a condition is apparent ; it means least installation for any given output, or greatest output for any given capacity of of generating plant. The group method of electric driving is much better adapted for small machines, up to and including 2-horse power capacity, and especially where such machines are in almost constant service. Above this size, individual motor driving becomes more and more efficient, particularly if the machines are operated only a fraction of the day.

ELECTRIC ELEVATORS.

THE electric elevator has gradually won its way to the confidence and favor of architects and building owners, and has recently achieved a marked triumph in being selected to convey visitors to the top of the Washington monument—a sheer lift of 498 feet. The elevator is capable of carrying thirty-five passengers and makes the ascent in five minutes. Its operation is said to be easy. It is at all times under perfect control and is carefully fitted with safety devices. The elevator was made and installed by the Marine Engine and Machine Co., of New York, and is operated from a small power house situated 750 feet west of the monument.

THE WATER POWERS OF SWEDEN.

A recent report of the Swedish Agricultural Department estimates the available energy of the principal waterfalls in Sweden at from 2,000,000 to 4,000,000 horse-power. It is not stated whether these figures apply only to sites which may be developed at ordinary expense or include all practical water-powers. It is pointed out that the national coal bill for last year amounted to 64,000,000 crowns, and that this sum might be considerably diminished by the employment of the natural motive power possessed by the country.

THE A. I. E. E.

THE American Institute of Electrical Engineers will meet in annual convention in the New York State Building, on the Pan-American Exhibition Grounds, Buffalo, on Tuesday, the 20th inst. Only morning sessions will be held, at which abstracts of papers will be presented on a variety of subjects, including one by Mr. W. S. Aldrich, of Toronto, and Mr. H. W. Redfield, on "Electric Transmission Systems."

QUESTIONS AND ANSWERS.

Central station manager writes : I am going to put up a three-phase transmission line, about nine miles long, using 6,000 volts ; how often should it be transposed so as to avoid unbalancing of the voltage at the receiving end ?

Answer.—If you put your line up in the shape of an equilateral triangle, and your load on all three wires is approximately equal, there will be no need for any transpositions, but if you are likely to have loads very much unbalanced, or if your line is to be strung in any shape but that of an equal sided triangle, you should transpose it twice, one-third of the way from each end.

" Operator " asks : How do you reverse the direction of rotation in a direct current shunt or series motor, and in single, quarter and three phase induction motors ?

Answer.—Direct current motors, both series and shunt, are reversed by changing the direction of the current through either the armature or the field ; if it be reversed through both simultaneously, that is, if you merely reverse the two leads which supply current to the machine, the direction of rotation will remain the same. Single phase induction motors which are not wound so as to have any definite direction of rotation, will continue to revolve in the way they are first started, that is, without changing any connections they will revolve in either direction, provided they are first started that way by some external means. Quarter phase motors need to have the connections of one phase reversed ; reversing the loads to both phases will keep the motor running in the same direction. Three phase motors need to have any two leads interchanged.

" Student " asks : Does it make any difference to a street railway system whether the trolley is positive or negative ?

Answer.—It makes no difference whatever to the operation of the cars and plant, though it is usual to make the trolley positive in order to reduce to a minimum the effects of electrolysis on the various water and gas pipes running adjacent to the rails of the system.

J. R., Montreal : What horse power per drill does it require to run an ordinary air compressor for mining work ?

Answer.—It is usual to reckon on 12 to 14 horse power for each drill, though this figure is somewhat altered by the elevation of the plant above sea level.

Mining Engineer : I am thinking of putting in a transmission plant to supply a mining camp with light and power, and would be glad of your advice as to the best system to use

Answer.—Without various particulars as to the head of water you have available, the length of your line, the amount of power you want to deliver, etc., etc., it is absolutely impossible to give you any reasonable recommendations as to the plant most suitable for your needs, though generally speaking, we would say that a 40 cycle three-phase installation, using direct-coupled generators, would be the one most suited to the majority of cases.

F. T., Toronto : What is the lowest circuit frequency on which arc and incandescent lamps can be run ?

Answer.—Arc lamps for out-door use are quite satisfactory on 40 cycles, though for inside work they are somewhat too unsteady. Below this frequency their performance in any situation cannot be considered satisfactory. Incandescent lamps, if of fairly low voltage, and therefore, heavy filaments, give good service at a frequency as low as 40 cycles, though if the use of 220 volt lamps be attempted, there will be noticeable flickering ; on the other hand, 52 volt lamps will give fair service on a frequency as low as 30 p.p.s.

R. M. writes : Why are street railway motors always series wound, instead of shunt ?

Answer.—Because the shunt wound motor would run when supplied with a given voltage at approximately the same speed irrespective of the load, which would mean that when going up heavy grades the armatures would be overloaded beyond a safe point, also it would not be possible to get a five shunt winding into as small a space as the series coils will go, due to the extra amount of insulation necessary, and the heating and the chances of trouble would both be increased. Again, the circuit through the motors is often broken for an instant, due to dirt, snow, etc., on the track, and if the motor were shunt wound the field would take so long to come up, due to its large self induction, as compared with that of the armature, that the current through the latter would reach far beyond a safe amount before the field had got any strength ; whereas if the motor is series wound, the armature and field currents must be identical.

" R. M.," Vancouver : What is considered to be the ordinary coal consumption per indicated horse power hour for engines running under the conditions which obtain in the usual engine room ?

Answer.—The very best results that have been obtained with compound condensing engines show a coal consumption little, if anything, below 1 1-2 lbs. per I.H.P., while on the other hand, there are many plants, which are not considered by their owners to be by any means out of date, whose coal bill will run up to 6 or 7 lbs. We would imagine that any simple non-condensing engine that produced an I.H.P. on 3 lbs. of coal, was giving good service, this figure being reduced by about 10 per cent. if the engine be compounded, a further reduction of 15 per cent. being accomplished by running it condensing as well.

PAN-AMERICAN EXPOSITION SEARCH-LIGHT SIGNALS TO TORONTO.

Signals from the 30-inch search light, on the electric tower of the Pan-American Exposition, were sent to Niagara Falls on July 25th, by Prof. Geo. F. Sever, Superintendent of Electrical Exhibits, in the presence of the electrical jury, thus demonstrating the feasibility of this method of signalling at night.

Since that time search-light signals have been sent from Buffalo to Toronto, a distance of 58 miles, through arrangements completed by Prof. Sever, in co-operation with Mr. Wm. S. Aldrich, consulting electrical engineer, of Toronto. The first trial was made 9.10 p.m., August 9th, with clouds over Toronto. The local illumination of the overhead sky by the electric arc lights in the streets of Toronto effectually prevented any discrimination being made between the local and the Buffalo illumination of the clouds. The second trial was made 9.50-10.15 p.m., August 13th, with a perfectly clear atmosphere. Owing to the smoke settling down over the city, no signal could be discerned from the top of the municipal hall tower, Toronto. This was the pre-arranged objective point for both experiments.

Special long-distance communication was arranged between the top of this tower and the electric tower at the Pan-American through the courtesy of the Bell Telephone Company, represented by Mr. K. J. Dunstan, of Toronto, so that every detail of the experiment could be followed. The special instructions were to depress the search-light to the lake horizon, bearing on the municipal hall tower, Toronto, then to sweep the horizon a definite angle to the right and left of this bearing, and later to elevate and depress the light at the original bearing. All of these signals were very clearly discerned during the second trial by Mr. C. H. Rust, city engineer of Toronto, with party located on Centre Island, two miles off shore from the city.

The electric tower of the Pan-American, 390 feet high, is distant 58 miles in an air line from the municipal hall tower, Toronto, 300 feet high. At this distance one degree of arc in the horizontal movement of the search-light would move it across the horizon at Toronto one mile, thus enabling the operator at Buffalo to throw the light to any desired point along the lake front at Toronto. The dip of the horizon at this distance was calculated by the formula used by the Hydrographic Office, U. S. Navy Department, as follows :

Distance in statute miles equals 1.31 × [illegible]

The difference in level between Lake Erie and Lake Ontario of 326 feet was also taken into consideration. The true bearing of the Toronto tower from the electric tower was found to be north 25 degrees west.

ELECTRIC RAILWAY DEPARTMENT.

ELECTRIC LOCOMOTIVE FOR A PULP COMPANY.

The accompanying illustration represents an electric locomotive recently built at the shops of the Quebec Railway, Light & Power Company, of Quebec city, for the Chicoutimi Pulp Company, of Chicoutimi, Que. It was designed by Mr. Russell, the general superintendent, and is intended for the shunting of regular freight cars about the company's yards, and for hauling the products from the mills to the company's wharves on the Saguenay river.

The dimensions of the locomotive are : Length over all, 17 feet ; width, 7 feet 6 inches ; wheel base, 7 feet 6 inches ; gross weight, 43,500 pounds. The frame is very strong and of substantial construction, of oak, with panelling of whitewood. The doors, windows, sashes, etc., are of cherry, and all wood and iron work is nicely finished, painted and varnished.

The motor equipment consists of two Westinghouse No. 56-55 h.p. motors ; gear ratio, 14.68 on 4 1-2 inch axles and heavy 33 inch wheels. The cab contains the following equipment : One G. E. type K. 11-S.P. controller ; one Westinghouse automatic circuit breaker ; one choke coil ; one Westinghouse rotary air pump ; one Westinghouse engineers' automatic brake valve ; one quick-break switch



Electric Locomotive.

for air motor ; one air gauge and automatic pressure regulator ; one large air reservoir ; and one hand brake.

The locomotive is equipped with Westinghouse automatic quick-action air brakes, with train line connections at each end.

The railway lines of the Chicoutimi Pulp Company consists of about two miles of track having an average grade of 2 1-2 per cent. The only heavy grade on the line is 400 feet of 5 per cent.grade and 39 degrees curvature. In a trial test at the shops of the Quebec Railway, Light & Power Company, the locomotive started and speeded up a train of twelve passenger coaches aggregating a total weight of 255 tons. A speed of about ten miles per hour was accomplished with comparative ease, the current consumption being 100 amperes per motor on start, and 115 amperes per motor on speed. The wheels skidded at 160 amperes per motor, with an equivalent draw-bar pull of nearly 8,000 pounds, or one-fifth of weight on drivers.

Through the kindness of Mr. D. E. Blair, we may at a later date give some details regarding the operation of the locomotive.

Mr. Charles Tessereau, for twenty-six years in the employ of the G.N.W. Telegraph Company at Montreal, has been appointed chief of police at Lachine, Que.

EFFECT OF TEMPERATURE IN RAIL MAKING.

It has for years been known to all rail makers that bars finished at reduced temperatures yield a better service than those turned out at the former high temperatures, and we notice that the Pennsylvania Railroad Company specified in its contracts this year that the rails must be finished at a low heat. Mr. R. W. Hunt, of the above railway, states that under the old conditions the temperature at which sections of rails at 80 lbs. per yard were finished in most rail mills averaged 1,795 degs. Fahr., as observed by the "Lunette" pyrometer. The following observations have been made under existing conditions, in altered rolling mills, on 80 lbs. per yard and some lighter rail sections : —Temperature of partially formed rails when first placed on cooling table, 1,742 degs., 1,772 degs., 1,772 degs., 1,742 degs., 1,772 degs., 1,772 degs.; average, 1,762 degs. Fahr. The temperature of finished rails on leaving the rolls averaged 1,580 degs. Fahr. The rails remained on the cooling table for periods varying from 1 min. 6 sec. to 1 min. 20 sec. It was found that the saws, to yield a rail of 80 lbs. section, 30 feet long, had to be set quite 1 inch nearer together than under the old practice.

TESTS OF TROLLEY WIRE.

Mr. A. L. C. Fell, in a recent paper descriptive of the equipment of the Sheffield electric railway system, mentions the fact that of late the British manufacturers of copper wire have greatly improved the quality of their product. He also refers to the satisfactory results obtained from the use of a patent trolley wire known as Phono-electric, as follows : —

"So far excellent results have been obtained, the only disadvantage being that the conductivity is only about 50 per cent. that of pure copper, but it only means a little more copper in the feeder cables to make up for the loss in the trolley wire, and this is as nothing in comparison to the benefit derived by having the number of broken trolley wires reduced to a minimum. On the average, it was found that the Phono-electric trolley wire gave about 50 per cent. greater tensile breaking strength and withstood about 2 1-2 times the torsion breaking strain of good, hard-drawn copper. The accompanying table gives the results of a comparative test made on hard-drawn copper and Phono-electric trolley wire :

Sample	Original Dimensions. Diameter	Original Dimensions. Section.	Length Inches	Elongation Inches	Stress Tons Total	Stress Tons Sq. In.	Twist in inches.
Phono-electric	0.324	0.082	[illegible]	[illegible]	2.07	36.22	[illegible]
Copper	0.324	0.082	[illegible]	[illegible]	2.05	[illegible]	[illegible]

PUBLICATIONS.

Messrs. Thos. Andel & Co., 63 Fifth avenue, New York, are the publishers of a new book called the "A B C of the Telephone," a practical treatise on the construction and operation of telephonic apparatus, circuits and exchanges. The subject of private intercommunicating telephone systems is also fully treated, being illustrated with diagrams of wiring, containing descriptions of the most practical switching devices, and numerous representations of specially constructed apparatus.

Herr Rathenan, the manager of the Berlin Electrical Works, has informed the German Emperor that a number of prominent German financiers and banks, in conjunction with Messrs. Siemens and Halske, the Allgemeine Elektricitats-Gesellschaft, the firm of Friedrich Krupp, of Essen, and others have formed a syndicate to study the problem of working a "lightning" railway from Berlin to Zossen. By its means it is hoped to attain a speed of from 125 to 160 miles an hour with electric cars, one of which is already being built by the Allgemeine Elektricitats-Gesellschaft, and the other by the firm of Siemens Halske.

ENGINEERING and MECHANICS

CANADIAN ASSOCIATION OF STATIONARY ENGINEERS.

THE ANNUAL CONVENTION.

THE delegates appointed to represent the various branches at the coming annual convention of the Canadian Association of Stationary Engineers are looking forward to a pleasant and profitable time. The convent on will be held in Brantford on Tuesday and Wednesday, August 20th and 21st. The opening session will be held at 11 a.m., when the delegates will be welcomed by the civic authorities. In the afternoon there will be a business session until 4 o'clock, when the delegates and visitors will be given a drive, through the courtesy of the Waterous Engine Works Company. At 8 p. m. there will be an open meeting, at which papers on engineering topics are expected to be read by Messrs. E. J. Philip, A. M. Wickens and Charles Moseley.

The greater part of the second day will be taken u) by business sessions, and in the evening the annual banquet will take place. The members at Brantford are putting forth their best efforts to make the convention a success from a social standpoint. The executive officers of the C. A. S. E. are : G. C. Mooring, Toronto, president ; Charles Moseley, Toronto, vice-president ; A. M. Wickens, Toronto, secretary ; W. Oelschlager, Berlin, treasurer ; George Dawson, Hamilton, conductor ; James Dixon, Toronto, doorkeeper.

HAMILTON NO. 2.

The annual outing of Hamilton Branch No. 2 C.A.S.E. was held on the evening of July 31st on the beautiful steam launch "Ampere," owned by Bro. Allen Marshall. The trip across the bay and out into the lake was very pleasant ; the moon was in her glory, shining over the waters, and every person enjoyed themselves. The main feature was no ladies were allowed on board. Mrs. Marshall sent an abundant supply of refreshments. The engineers exhausted their energy in singing. Bro. Morris, in his fine voice, gave two songs, and Bros. Ironside, Dawson and Chub rendered a trio with a chorus "When we Go to Brantford." A hearty vote of thanks was tendered Bro. Marshall and Mrs. Marshall.

At the aunual installation a short time ago Ald. R.C. Pettigrew was installing master. A feature of the meeting was a presentation of a handsome umbrella to Bro. James Carroll, the retiring financial secretary.

INSTRUCTIONS FOR SETTING UP, OPERATING AND MAINTAINING STATIONARY BATTERIES.

A catalogue recently issued by the Gould Storage Battery Company, Depew, N. Y., contains the following rules and instructions for batteries, which are well worth reproducing.

1. Unpack the cases carefully, opening them from the marked side, and clean elements and containing cells (glass jars, rubber cells or lead lined wooden tanks, as the case may be).

2. In moving elements, always lift them by both top bars.

3. Place cells in desired position, leaving a space of about one inch between jars on battery stands, which should be erected in a cool, accessible place, where they will not be exposed to dust or dampness.

4. Scrape lead connecting lugs and connect up, being careful to join adjacent cells in series ; that is, positive to negative. The positive plates are stamped P or +, and are of a dark brown color, while the negatives are of a dark gray. Screw connecting bolts or binders up tightly.

5. The acid solution should be mixed one day before it is wanted for use, to allow it to cool. Under no circumstances fill cells with warm acid. The acid solution should have a strength of twenty-five degrees Baume, which should be maintained at all times when cells are fully charged.

6. If current for charging be available, acid solution may be poured in the containing cells, one-half inch above plates, but do not fill cells unless they can be connected to the charging circuit at once.

7. Immediately after filling cells, connect charging current and charge at one-half normal rate for four hours, then increase to normal rate, and charge for about twenty hours.

8. Before closing circuit, be sure that the dynamo positive is connected to battery positive, and dynamo negative to battery negative, and that the voltage of the dynamo is 10 per cent. higher than the battery voltage.

9. At the end of the first charge, each cell should read 2.7 volts, and gas should be given off freely, the solution assuming the appearance of boiling.

10. Subsequent charging should be stopped when voltage is 2.6 volts per cell and gas is given off.

11. Discharge should be stopped and cells immediately recharged when voltage is down to 1.8 volts per cell when discharged at normal rate.

12. Always keep the plates well covered with the electrolyte acid solution.

13. Exclude all dirt, metallic particles or foreign matter from the cells.

14. Test cells individually at regular intervals with both hydrometer and cell tester. Should any cell read low, cut it out of circuit for one discharge (thereby giving it an extra charge.) If this does not bring it up to the proper condition, disconnect, take it apart, lifting the element from the jar by grasping it firmly by both cross bars, and wash it well, removing with a stick any foreign material which may adhere to the plates ; attend to a low reading cell at once ; do not wait.

15. Go over all connections regularly, and see that they are kept clean and tight.

STEAM ENGINE SPECIFICATIONS.

The Engine Builders' Association of the United States has submitted for the consideration of architects and engineers the following suggestions in connection with specifications for the installation of steam engines :—

(1) That contracts which provide a penalty for failure to deliver in time or for failure to meet guarantee ought also to provide equal premiums for earlier or better results than specified. (2) That bonds should not be required on installation contracts unless corresponding bonds for similar amounts are given to secure payment. An exception always being made in the case of government, state or municipal contracts. (3) That settlements or any part of them ought not to extend beyond three months from completion of contract, and that delay on the part of the owner ought not to delay payment beyond a reasonable time. (4) That a guarantee against defective material or workmanship should not be made to cover a period of more than one year from date of shipment. (5) That purchasers of engines ought not to be furnished with complete working drawings, but simply with general drawings, showing the assembled engine in outline, with such principal dimensions as will answer for building foundations, the erection of engines or their care.

EFFICIENCY OF THE GAS ENGINE.

At the recent meeting in Milwaukee of the American Society of Mechanical Engineers, a paper was presented by Mr. C. H. Robinson, in which were given the results of efficiency tests of a 125 h.p. Westinghouse gas engine. The average thermal efficiency of the engine was 20.05, the highest being 23.24 per cent ; the figures correspond to 171.66 and 226.13 B.T.U. per indicated horse-power-minute, respectively. The mechanical efficiencies corresponding to these tests were 79.39 and 89.05 per cent. respectively. Tests were made to determine the distribution of heat in the engine. At the lowest horse-power of the series 10 per cent. was accounted for by the indicator, 32 per cent. went out in the exhaust and 58 per cent. in the jacket water. At the highest horse-power (164 indicated) these figures became 26, 44 and 30 per cent, respectively.

Under the title "Electrical Designs" the Norman Electrician Company, of New York, have issued a published a book of 200 pages. Instructions are given constructing small motors, testing instruments and other apparatus, accompanied by working drawings for each design.

BOILER EXPLOSIONS.

An exhaustive report published by one of the leading boiler inspection companies in New England states that the total number of boiler explosions during last year in the United States was 373, as against 383 in 1899. There were in all 268 persons killed as a result of these explosions, against 298 last year, and 520 injured, against 456, making a total of 788 killed and injured, as compared with 754 the previous year.

Officials of boiler inspection companies find it difficult to account for the fact that boiler explosions in the United States are so much more numerous and destructive than those in Great Britain, where the total number of those killed and injured was only 89 last year.

The average number of explosions in the United States exceeds one a day, and inspectors say that the ratio of boilers to those in use in Great Britain show nothing approaching these casualties in comparison.

No explanation of this disparity can be vouchsafed. The president of one of the largest companies in the country says that after much investigation he is utterly unable to offer any solution of the problem which appears to be reasonable and adequate.

BOILER INSPECTION IN MONTREAL.

The city boiler inspector has completed his report for 1900. It shows the following inspections, etc., were made during the year :

Inspection of steam boilers—Visits of inspection, 1410 ; internal and external inspections, 763 ; hydraulic tests, 426 ; hydrostatic tests, 33.

The results of these visits were as follows : Boilers condemned as unsafe, 6; boilers found imperfect, 137 ; boilers erected during the year, of which five were second-hand, 48; notices of inspection served, 256 ; certificates issued, 417.

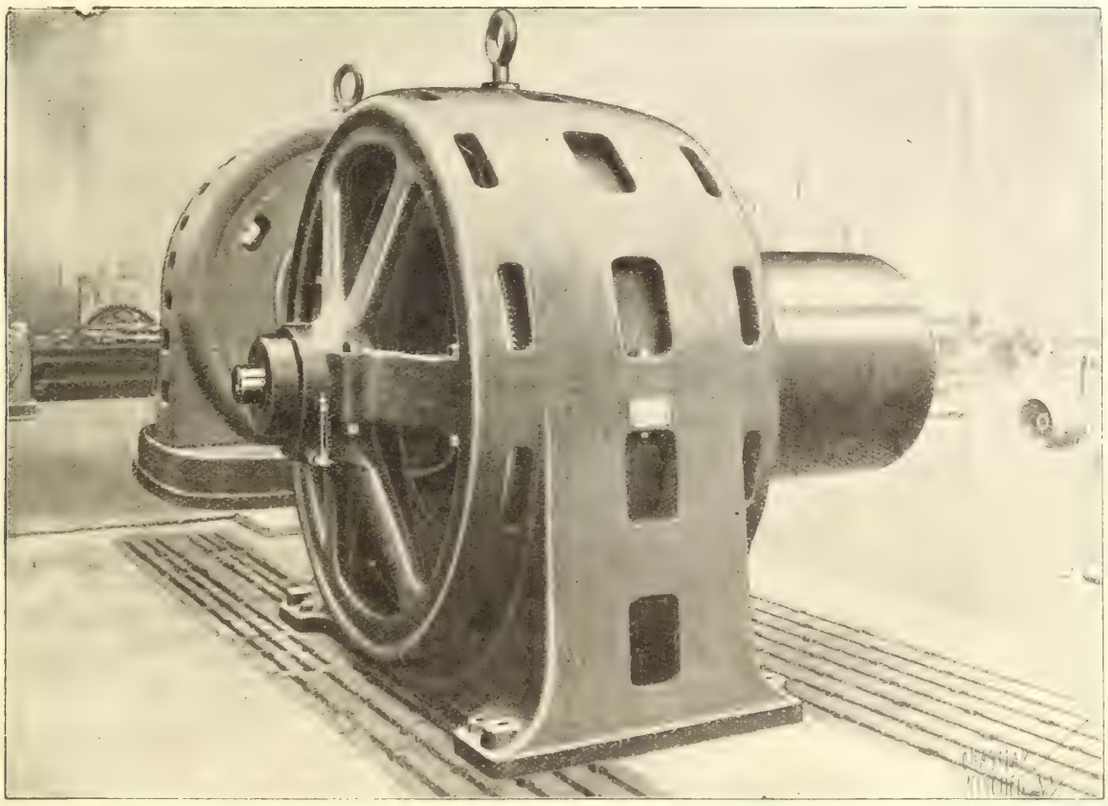
Candidates for engineers' certificates—Certificates issued to 448 ; failed to pass examination, 37. Total 486.

There were fewer boilers erected the past year than in 1899, but their capacity of horse-power is greater.

The new century opens with a clean record as regards any boiler explosions during the existence of the department, namely, 21 years.

WESTINGHOUSE MOTORS.

The illustration herewith represents an induction motor manufactured by the Westinghouse Electric & Manufacturing Company, several of which are in operation in the works of the E. B. Eddy Company at Hull, opposite Ottawa. The motors are used for driving pulp and paper machinery, and are supplied with current from the Deschenes Rapids, seven miles above the Eddy Company's works. The motors were furnished and installed by Ahearn & Soper, Limited, the aggregate capacity installed in the Eddy works being 1,500 horse power.



TYPE OF WESTINGHOUSE THREE-PHASE MOTOR INSTALLED BY AHEARN & SOPER FOR E. B. EDDY COMPANY, HULL.

Some 4,500 horse power in capacity of the same type of motors have been installed by Ahearn & Soper, Limited, in the mills of the Dominion Cotton Mills Company, and the Montmorency Cotton Mills Company, Montmorency. The same firm has installed a number at the Magog Cotton Mills.

Montreal Branch No. 1, Canadian Association Stationary Engineers, at its last regular meeting at 1863 Notre Dame street, elected these office-bearers for the year : President, J. G. Murphy ; first vice-president, H. Wadey; second vice-president, H. J. Weaver ; treasurer, Thos. Ryan ; recording secretary, Wm. Smythe ; corresponding secretary, H. Marchand; financial secretary, H. Nuttall ; doorkeeper, H. Knight; conductor, Alex. Adams ; librarian, W. Ware ; trustees, Geo. Hunt, W. Ware and F.H. Thompson.

MONTREAL

Branch office of the CANADIAN ELECTRICAL NEWS,
Imperial Building,

MONTREAL, AUGUST 5TH, 1901.

Montrealers enjoy cheap light, and from recent advertisements in daily press, it seems that the Lachine Company are determined to keep us protected, as they state they will meet any cut rate the new combine offer. Up to date the Lachine Company strenuously deny that they will enter the combine, but money tells, and all things are possible.

The Power, Heat & Light Company (Royal Electric) are busy pulling down old houses and clearing away generally on the property lately acquired, with a view to pushing through the new sub-station which is required owing to their additional requirements.

A few years ago the National Board of Fire Underwriters "kicked" at the grounding of the neutral wire in the three wire system. Now, if al, stories be true, they permit it. If so, it would seem that some of the regulations are jotted down with insufficient forethought.

The practice of college professors accepting fees for outside consultations, etc., is being discussed by one of our foremost engineering societies. Some are of the opinion that such practice is unfair and should be frowned down.

Fifty-two volt is evidently "doomed"; in fact, fan motors and other accessories for such are now dubbed old style. The call for apparatus of that voltage is gradually becoming less and less, and 104 and 110 is rapidly replacing it. Probably it will not be many years until 220 is replacing these latter. It is the non-applicability of the fittings at present on the market which retards this advance, more than the factor of the inefficiency of the 220 volt lamp.

One of the prettiest residential spots on the island of Montreal is on the slope of the little mountain in the suburb of Wettmount. Unfortunately, however, the residents of that locality are frequently treated to volumes of dense black smoke from the chimney of the upper level pumping station, the property of the Montreal Water Power Company. We are given to understand that the engine will shortly be replaced by an electric motor, which not only will be a source of greater comfort, but will probably enhance the value of property in the district. It is said that the motor will be from the works of the Bullock Electric & Manufacturing Company, which firm have lately completed a contract for press driving motors for the Montreal Daily "Star."

The Montreal Park & Island Railway has been virtually taken over by the Montreal Street Railway to the benefit of the citizens generally and to those in the surrounding municipalities. The M. P. and I. Ry. has been a sort of one-horse concern from its conception, blocking the M. S. Ry. from getting right of way in municipalities where they could have run belt lines in connection with their city service and giving an infinitely superior service. Notably in the municipality of St. Louis de Mile End there has been quarreling between the M.P. & I. Ry. and the municipal authorities, also the municipality of Outremont have been "kicking." Already the evidence of more progressive management is seen in the Mountain Belt Line, which goes right around without change and which was a perfect god-send to many during our hot spell.

OLD-TIME TELEGRAPHERS' ASSOCIATION.

The twent-first annual re-union of the Old-Time Telegraphers' Association and the Society of the United States Military Telegraph Corps will be held in the city of Montreal, on September 11th, 12th and 13th. Mr. L. Bi McFarland, of the Bell Telephone Company, Montrea,, is nresident of the Old-Time Telegraphers' Association, and Mr. J. Hutcheson, of the Ottawa Electric Railway Company, vice-president.

The following programme has been arranged:

Wednesday, September 11. 10.00 a. m.—Meeting of O. T. T. A. and U. S. M. T. C. in the Ladies' Ordinary, Windsor Hotel. Address of welcome by his Worship Mayor Prefontaine, M. P. 10.30 a. m.—Business Meeting, O. T. T. A. The "Telegraphers' Home" project will be brought up for discussion and a proposition to merge the "Telegraphers Historical Society of North America" will be considered. 11.30 a. m.—Business meeting of U. S. M. T. C. in the Ladies' Ordinary, Windsor Hotel. 2.00 p.m.—Drive through the city and up to the summit of Mount Royal. Thursday, Sept. 12. 10.30 a.m. Visiting Electrical Buildings. 2.00 p.m.—Trip on steamer "Duchess of York" via the Lachine Canal; Shooting the rapids and inspection of the harbor of the city of Montreal. 8.00 p. m.—Theatre party. Friday, September 13—2.00 p. m.—A trip by trolley cars and visit to the power plant of the Lachine Rapids Hydraulic and Land Company. 8.000 p. m.—Subscription Banquet, to be held at the Windsor Hotel.

BY THE WAY.

In point of extreme brilliancy the acetylene gas exhibit at the Pan-American Exhibition takes first place, but for beauty of illuminating effects, the management depend upon the incandescent electric lamps, 40,000 of which are in use on the electric tower. The effect produced by these lamps is the most beautiful that has ever been attained by any method of artificial illumination. Regret is expressed by visitors interested in electricity that no opportunity is afforded them of examining the Nerust lamps, which are in operation in the electricity building. These lamps are hung in an inconspicuous position, high up beneath the ceiling.

* * *

Toronto can now boast of having an automobile club, with a membership of twenty. Every Thursday evening the club assembles for a "run" over a pre-determined route. The vehicles are propelled by various methods—electricity, steam, gasoline, etc., and are fitted with lamps. They form an interesting and thoroughly up-to-date procession, and attract a full measure of attention en route. Toronto, with its comparatively level and well-paved streets, is well adapted to horseless vehicles. The number of vehicles, both for pleasure and business purposes, is rapidly increasing.

* * *

The experience of Mr. R. F. Hayward, chief engineer of the Utah Light and Power Company, of Salt Lake City, is, that in pole planting a liberal application of salt around the pole while the dirt is being filled in and tamped, is the best method which can be adopted to prevent decay. I think I hear somebody in a stage whisper remark "Cum grano salis." But why shouldn't salt as efficiently preserve an electric light pole as a side of bacon? We are not told what quantity of salt per pole is required, therefore cannot judge whether or not the cost would be prohibitive. The experiment might easily have been tried here a few years ago, when American salt was selling on this market at 85 cents per barrel (and at $3.50 per barrel in Chicago). Since then, however, the manufacturers have formed a combine and are no longer cutting each others throats, consequently the price of the preservative has "riz."

MOONLIGHT SCHEDULE FOR AUGUST.

Day of Month.	Light	Extinguish.	No. of H...
	H.M.	H.M.	H.M.
1....	" 7.00	P.M. 9.30	2.30
2....	7.00	10.10	3.10
3....	" 7.00	11.00	4.00
4....	" 7.00	11.45	4.45
5....	" 7.00	0.40	5.40
6....	" 7.00	1.40	6.40
7....	" 7.00	2.45	7.45
8....	" 6.45	3.45	8.[illegible]
9....	" 6.45	4.45	[illegible]
10....	" 6.45	4.45	[illegible]
11....	" 6.45	4.45	10.00
12....	" 6.45	4.45	10.00
13....	6.45	4.45	10.00
14....	6.45	4.45	10.00
15....	6.30	5.00	[illegible]
16....	6.30	5.00	[illegible]
17....	6.30	5.00	[illegible]
18....	7.40	5.00	9.20
19....	8.30	5.00	8.[illegible]
20....	9.15	5.00	7.45
21....	10.15	5.00	6.45
22....	11.10	5.10	[illegible]
24....	A.M. 0.10	5.10	5.00
25....	1.15	5.10	3.55
26....	" 2.30	5.10	2.40
27....	No Light.	No Light.	
28....			
29....			
30....	P.M. 6.15	A.M. 0.00	5.45
31....			
		Total	187.[illegible]

WANTED.

Wanted an Electrical [illegible] stating wages and experience to
THE CANADIAN GENERAL ELECTRIC CO.,
Peterboro, Ontario, Canada.

FOR SALE.

CEDAR TELEPHONE POLES.

All lengths [illegible] or write for car lots [illegible] livered at any point in Canada or United States.
GEORGE & McGREGOR
Killaloe Station, Ont., Canada.

SPARKS.

The Cranbrook Electric Light Company, Limited, of Cranbrook, B.C., has been incorporated.

The United Electric Company, Limited, of Toronto, has been authorized to increase its capital to $300,000.

Negotiations are still in progress for the extension of the St. Thomas street railway to Port Stanley, Ont.

It is rumored that the capital has been secured for an electric railway between Cornwall and Trenton, Ont.

The town of Lindsay is reported to have given the contract for the town lighting to the Burgess Gas Company, of Toronto.

The town council of Perth, Ont., is about to make an offer to the Perth Electric Light Company for the purchase of its plant.

The Ottawa Electric Company purposes building a new distributing station on the canal reserve near the site of the new driveway.

The authorities of St. Catharines, Ont., are asking for tenders up to August 15th for lighting the streets of the city by arc lamps.

The Metropolitan Railway Company, of Toronto, have begun the construction of a branch of their railway from Bond Lake to Schomberg.

The Halifax Electric Tramway Company have been awarded the contract for lighting the streets of Halifax, N.S., for a period of five years.

On August 16th the ratepayers of Collingwood, Ont., will vote on a by-law to raise $10,000 for the improvement and extension of the electric light plant.

Mr. M. G. Cameron, of Goderich, Ont., will apply for the incorporation of a company to build an electric railway from Goderich to Kincardine and Southampton.

The plans of the Fort Erie Fesry Electric Railway, running along the west side of Niagara river from Chippewa to Fort Erie, have been submitted to the Minister of Public Works for approval.

The West Kootenay Light & Power Company, of Rossland, B.C., are said to have offered $50,000 for the electric light plant of the city of Nelson, B.C., and have made a proposition to light the city.

The British Columbia Electric Railway Company are installing new boilers in their power house at Vancouver. The work is being done under the superintendence of the chief engineer, Mr. K. G. Dunn.

The Renfrew Power Company, of which Mr. Thomas A. Low is secretary, have asked for tenders for construction of dam, flume and power house in connection with proposed water power development.

The town of Mount Forest are considering the advisability of purchasing the electric light plant. It is being valued and reported on by Mr. H. F. Strickland, of Toronto, but the deal has not been closed.

The Canadian Pacific Railway Company are considering the substitution of electric for steam power for hauling their trains in the high mountain grades of the Rockies, where there are immense water powers.

A dispatch from Norman, Ont., says: A large number of men will be employed setting up poles, stretching wires and erecting buildings at the dam for the transmission of 6,000 horse power of electricity to Winnipeg.

A complete electric light plant will be installed for lighting the proposed beet sugar factory at Wallaceburg, Ont. The contract for building the factory has been given to the Kilby Manufacturing Company, of Cleveland, Ohio.

The Brockville Recorder says concerning the municipal plant at Morrisburg, Ont.: "The electric light and power plant is getting on very slowly. It was to have been running last December, and it is an open question if it will be completed this coming December."

Mr. E. R. Woods, of the National Trust Company, Toronto, states that a Boston syndicate have recently bought the ferries running between Sydney and North Sydney, N.S., and the Sydney electric light plant, and will construct an electric railway between Sydney and Glace Bay, at a cost of $750,000.

The Cascade Power Company has commenced the work of building a pole line between Cascade, B.C., and Phœnix mining camp. At least 10,000 horse power, it is said, will be developed. The dam at the head of the falls on Kettle River is nearing completion, but the power house has not yet been erected.

Messrs. Alexander Fraser, W. C. Edwards, M.P., and other lumbermen of Ottawa, who have secured a franchise of the water power at Table Rock, on the Quebec side of the Chaudiere Falls, expect to develop 10,000 horse power, and will supply electric energy to the Consumers' Electric Company.

The Canadian Niagara Power Company have appointed Mr. Cecil B. Smith, of the firm of Smith & Aldrich, of Toronto, to be resident consulting engineer of the power development work to be carried out on the Canadian side. It is said that competitive proposals for the wheelpit contract will be invited immediately.

The Citizens Telephone & Electric Company, of Rat Portage, Ont., have asked for an injunction to restrain the town council from passing a by-law regulating the rates the company may charge for light. The company claim that under the existing agreement the council have no right to interfere at the present stage.

Mr. Barlow, employed by the Lachine Rapids Hydraulic & Land Company, Montreal, met his death last week while repairing the company's wires. He accidentally touched a live wire and was rendered unconscious. His body became entangled in the wires and before it could be removed was terribly burned, resulting in death in a short time.

It is reported that the Keewatin Power Company, of Keewatin, Ont., is taking tenders on the development of a water power at the outlet of the Lake of the Woods, it being the announced intention to install a plant capable of developing 6,000 horse power, most of which, it is said, will be transmitted to Winnipeg. According to the Winnipeg Free Press, it is the intention to construct two transmission lines so as to guard against interruptions from break-downs.

The nature of sound is explained in very simple language in the following inscription on Everett's model, 1863: "Silence in action is sound in motion. Sound and silence, then, belong to the order of dual substance in unity. This 'phonic unity I have discovered and demonstrated to be an independent imponderable phonic cystoplastic suisysmoris, which cannot be divided or destroyed. It resides in all non-metallic atoms, which not only part with it, but transmit, reverberate and absorb it."

U. S. Consul-General Mason at Berlin has found it necessary to forward to the State Department a correction of very generally published statements to the effect that new electric trains have been running at the rate of 125 miles an hour between Berlin and Hamburg. Mr. Mason says that a series of high-speed trials are to be made on an 18-mile line between Berlin and Zossen, aided by the German Government, in August and September, which will attract the electricians of the world. The greatest electrical house in Germany has built a special motor car, which is to run in competition with one made by one of the leading American concerns for this special test.

The Toronto Star says:—"A new game has been introduced into the city—invented here, because it is not known to be played elsewhere. Its only implement is any ordinary electric fan. The four flanges of the fan are marked, and each player puts up a sum of money to support his belief that his particular flange will stop at the top when the power being turned off by means of the switch, the fan of its own accord stops revolving. There are four flanges on most ordinary fans, and this easily allows four

players to bet at one time. Fewer than four can also play. Some people may recognize a similarity in principle between this game and roulet. But it is much more easily played."

The Hamilton Radial Railway Company have made arrangements for the extension of their line from Burlington to Oakville, and agree to have cars running to that town before June 1st, 1902.

At the third annual meeting of the Toronto Railway Electricians' and Mechanics' Benevolent Association, Mr. M. Power, master car builder, was elected president; S. Potter, chief electrician, vice-president; and G. Sweetlove, recording secretary.

Messrs. J. Wylie, A. G. Smith and John Boyd have formed a company to install an electric power plant at Whitehorse, B.C. The plant will be supplied with high-speed engines and two Westinghouse dynamos of 700 light capacity.

The Imperial Electric Light Comoany held their annual meeting in Montreal recently and declared a dividend of 7 per cent. Officers were elected as follows: V. Morin, president; Rod. Tourville, vice-president; Dr. Chagnon, treasurer; and Mr. Chapleau, managing director.

When the Duke and Duchess of Cornwall go out from Quebec to see the Montmorency Falls they will travel in some of the finest electric cars in America. The Ottawa Car Company has received an order for four special cars to be used for the first time when the Royal visitors are in the Ancient Capital. The Ottawa Car Company will make the cars as elegant as possible, and they will be modèls of beauty and unsurpassed by any in America. The cars will be open, and plate glass will be freely used, while the fittings will be of bronze.

The village council of Marmora, Ont., are considering the question of street lighting.

The Prince Edward Island Electric Light Company have been given a contract for the electric street lighting in Montreal for three years.

Arrangements have been made whereby the Hull and Aylmer electric cars will cross the interprovincial bridge between Hull and Ottawa, and in exchange for this privilege the Pontiac and Pacific Junction cars will run on part of the Hull & Aylmer Company's tracks.

THE OTTAWA ELECTRIC COMPANY.

The annual meeting of the Ottawa Electric Company was held in Ottawa last month, at which satisfactory reports were presented. The report of the directors showed that the gross receipts of the past year had been $196,363.22, an increase of $19,680.93 over the previous year. The gross expenditure was also greater, being $36,558.91 in excess of the amount expended last year. This was owing to the heavy losses sustained in the big fire, in which four of the company's power houses were burned, necessitating the operation of a steam plant to the fullest extent.

The number of incandescent lights now installed by the company is 93,207, which is an increase of 6,093 during the year. There have been increases in all other branches of the service and the total number of customers of the company is at present 5,208.

A resolution was passed setting forth the high appreciation by the directors of the services rendered by the president, Mr. T. Ahearn. Directors were elected, and at a subsequent meeting Mr. Ahearn was re-elected president, and Mr. F. P. Bronson vice-president.

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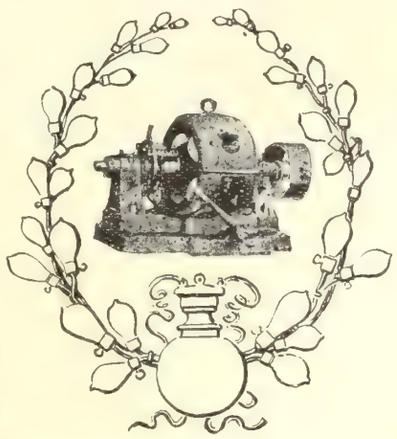
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The Stillwell-Bierce & Smith-Vaile Co., of Dayton, Ohio, have recently secured quite an extensive order for Victor turbines from the Wisconsin Traction, Light, Heat & Power Co., of Appleton, Wis. The job consists of 3,200 h.p., and the power will be used for driving the main power plant. Two 24-inch horizontal wheels will also be furnished for driving the exciters. The gate work will be of two units of wheels, each unit consisting of three pairs of 42-inch Victor turbines mounted on horizontal shafts. These wheels will develop the company's patented draw rod type.



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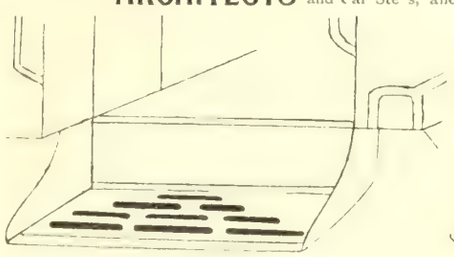
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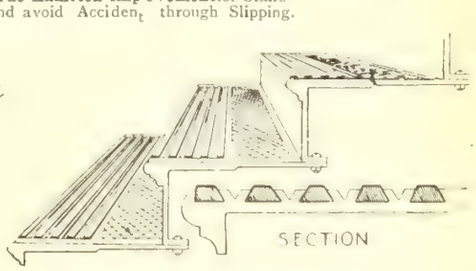
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SPARKS.

The Canadian General Electric Company have made a contribution of $20 to the Ottawa Firemen's Benevolent fund.

The Nanaimo Electric Light Company, of Nanaimo, B.C., have placed an order with the Canadian General Electric Company for a 2,000 light alternator.

August 20th has been decided upon as the date to begin arbitration proceedings to fix a price for the purchase, by the city of Kingston, of the plant of the Kingston Light, Heat & Power Company.

Only one tender was received by the town council of Outremont, Que., for electric street lighting. It was from the Lachine Rapids Hydraulic & Land Company, offering 2,000 c.p. lamps at $100 each per year. The contract has not been signed.

The Niagara, St. Catharines and Toronto Railway Company have served an injunction on the county council restraining them from granting privileges for a street railway to the Hamilton, Grimsby & Beamsville Electric Railway Company.

The municipal authorities of Port Arthur, Ont., have taken tenders for timber dam, pipe line and concrete work in connection with the development of the Current river water power. William Kennedy, C.E., of Montreal, is associated with the work.

The Royal Electric Company, of Montreal, have been given the contract for the lighting of the municipality of Longueuil for twenty years at a price not exceeding $116 per lamp a year. The company is given the exclusive privilege of supplying commercial lights.

In the July issue it was stated that Mr. W. C. Hawkins had been appointed manager of the light and power departments of the Hamilton Electric Light & Cataract Power Company. We have been requested to state that the position to which Mr. Hawkins has been appointed is general manager of the entire company.

Among the new companies incorporated by the Ontario Government is the Electric Supply Company, of Hamilton, capital $30,000, of which Messrs. Lowe & Farrell are the promoters, and the Otonabee Power Company, of Peterborough, capital $125,000. Messrs. W. G. Ferguson and A. Hall are directors of the latter company.

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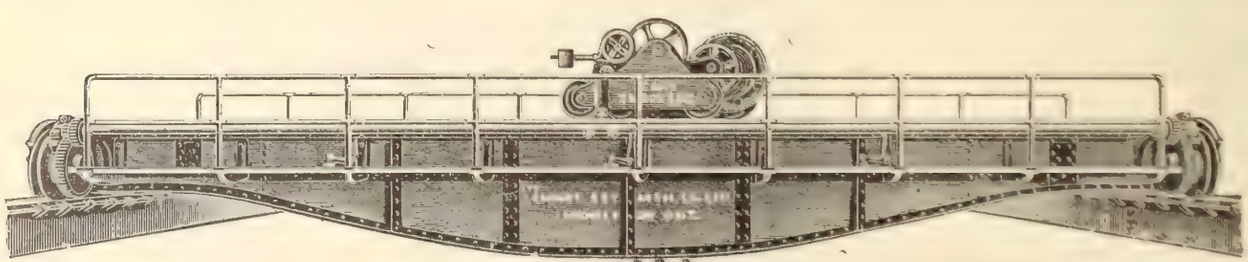


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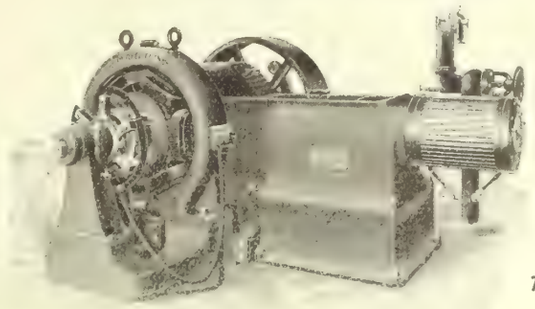
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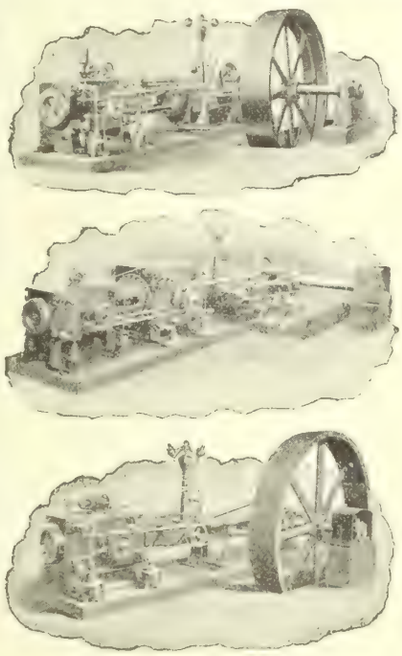


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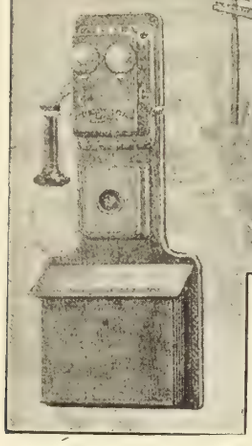
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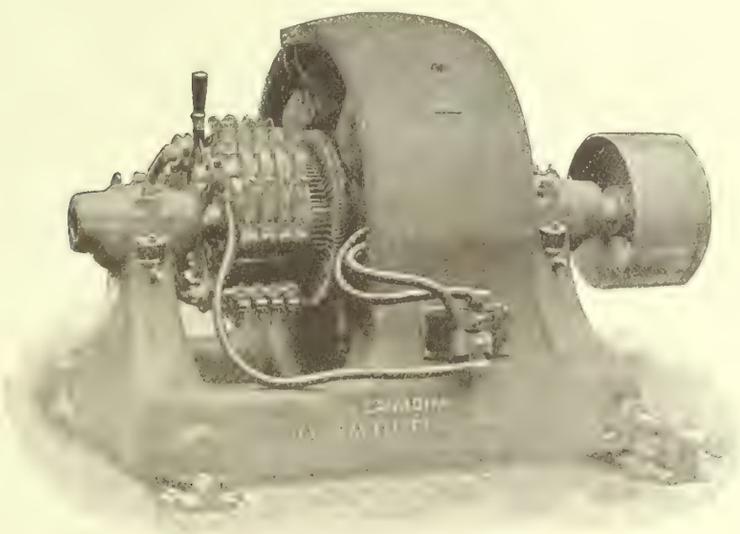
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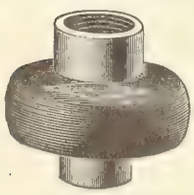


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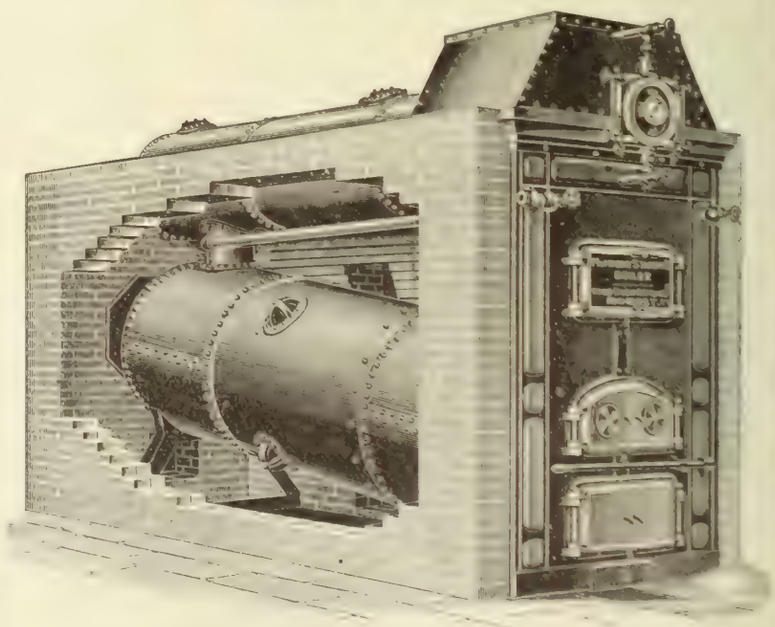
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SPARKS.

Mr. John Ashworth, of Bracebridge, Ont., has invented a street car fender.

Tenders have just been taken for building a brick addition to the power house at Huntsville, Ont.

The Milverton Light and Water Company, of Milverton, Ont., has been incorporated, with a capital of $20,000.

The Ottawa Electric Company is now building a brick and iron power house on Head street, at the Chaudiere.

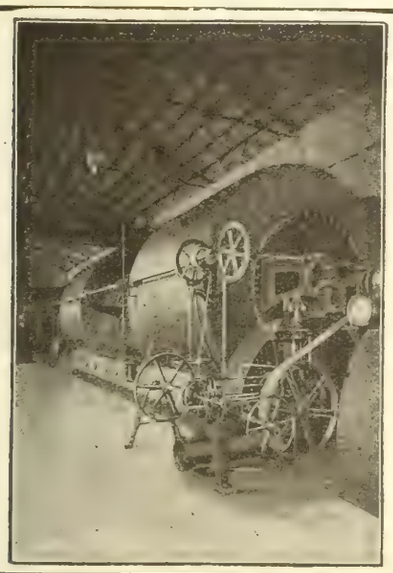
Mr. T. B. Caldwell has purchased the Malloch property at Calabogie, Ont., and will, it is said, develop the water power.

American capitalists are said to be negotiating for the construction of an electric railway from Woodstock to Goderich, Ont.

A by-law to authorize a loan of $12,000 for improvements to the water-works and electric light plants was carried at Kamloops, B.C., a fortnight ago.

The eleventh annual convention of the Association of Railway Superintendents of Bridges and Buildings will be held at Atlanta, Georgia, October 15th to 17th.

Electric light is to be more extensively used in the future at the Mother Load mine, near Greenwood, B.C., and the new buildings are being wired for the purpose.



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WRITE FOR CATALOG. DEPARTMENT E.

SPARKS.

It is probable that the power house of the South Essex Electric Railway Company will be bnilt at Sandwich, Ont., that town having offered exemption from taxation.

The town council of Collingwood, Ont., are about to ask for tenders for two steam boilers of 120 horse power and one 2,000 light dynamo for the electric light plant.

The ratepayers of Iroqouis, Ont., will vote on a by-law on October 1st, to raise $12,000 for the installation of an electric light plant. Mr. Allan McInnis is clerk of the village.

The town of Mount Forest, Ont., is about to take over the plant of the Mount Forest Electric Light Company, a by-law to end having been carried by the ratepayers on August 23rd.

A reduction in the prices of fares was recently made by the tramway company at Nelson, B.C., but the receipts since that time have been greater than before the reduction was made.

The Montreal Street Railway Company are making extensive alterations to their power house on William street. Two 1,600 horse power engines and new dynamos are being installed.

The town council of Aylmer, Que., proposes to take over the water-works system and establish in connection with it an electric lighting plant, to be owned and operated by the town.

A syndicate has applied for power rights on the Coquitlam river, near New Westminster, B.C., the object being to supply light and power to the cities of New Westminsrer and Vancouver.

Mr. E. S. Harrison, of Winnipeg, has purchased a controlling interest in the Central Electric Company, of Portage la Prairie, Man. Mr. Harrison is puttlng in 2,200 candle power lamps for street lighting.

The citizens of Port Arthur, Ont., will vote on a by-law on September 11th to raise $30,000 for the completion of the Current river power development. The actual cost of the work will be about $50,000.

The municipality of Westmount, a suburb of Quebec, is considering the advisability of installing a municipal electric light plant. The street are now lighted by the Citizens Light & Power Company.

A syndicate of Montrealers, under the direction of Hanson Bros., is about to take over the Pontiac & Pacific Junction railway, the Hull & Aylmer railway, and the Interprovincial bridge between Hull and Ottawa.

The city of St. Catharines, Ont., recently invited tenders for electric lighting. Only one tender was received, from the local company which asks $79 per lamp per year on a five year contract, or $76 per lamp per year on a ten year contract.

The Canadian General Electric Company are building the machinery for lighting the Lachine Canal near Montreal, while Ahearn & Soper, of Ottawa, have the contract for poles and wire. The power house is being built at Cote St. Pauls.

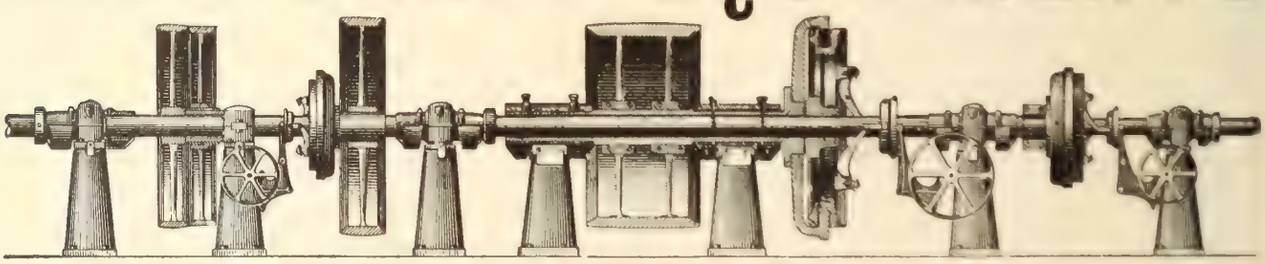
A meeting of the shareholders of the Petrolea & Corruna Electric Railway Company was held in Sarnia last month. The contracts for the rails, poles, etc., will be given out at once, the intention being to push the line through to Sarnia early in the spring.

The Everett-Moore Syndicate has completed the purchase of the Sandwich, Windsor & Amherestburg electric railway. The consideration has not been named, but it is understood that the property is valued at about $400,000. This syndicate now controls the entire railway system on both sides of the Detroit river.

Mr. R. M. Horne-Payne, managing director of the British Columbia Electric Railway Company, states that it is the intention to double the capacity of the power house in Vancouver and to put in one of the most complete lighting plants on the coast. Altogether, a large sum of money will be expended on the proposed improvements.

The Royal Military College, Kingston, Ont., has purchased a large isolated plant, to be used for both commercial lighting for and scientific experiments. The firm of Breck & Halliday, of Kingston, have secured the entire contract. The plant will consist of two Canadian General Electric Company's 24 K.W. generators, direct connected to two 9x10 Ideal engines, together with three marble switchboards and a large storage battery plant of 64 cells. The entire order for generators, engines, switchboard supplies, etc., are given to the Canadian General Company, and the order for boilers was given by Breck & Halliday to a local company.

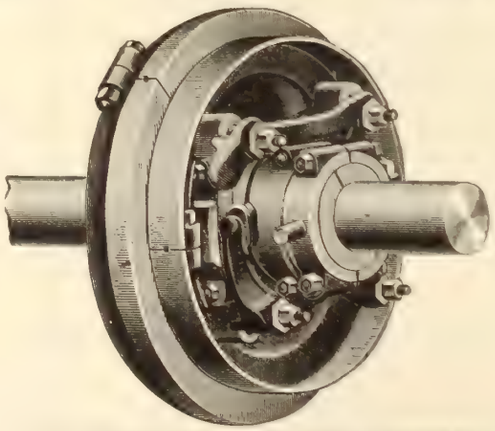
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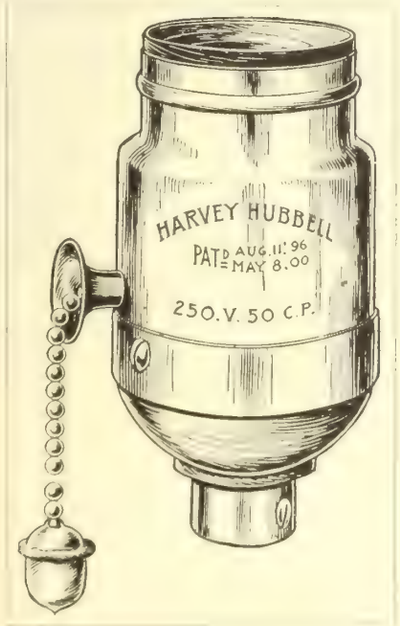
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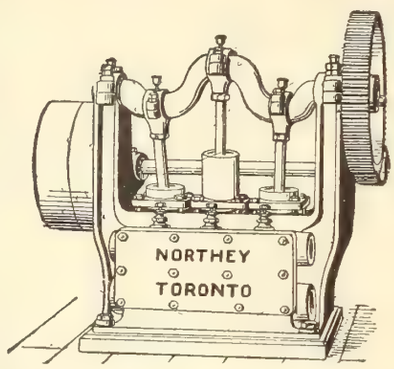
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In the Northey Triplex Power Pump we offer a machine put together with skill brought by years of experience in pump building, and with full provision made for the varied demands likely to be made upon a pump of this general character. A feature of value is the situating of the three cranks 120 degrees apart, thus giving a practically constant flow of water, minimizing strain on pump and economizing power. The Pump can be readily re-packed and taken up, and all details are most carefully worked out; it can be conveniently operated by electricity, by water power, or by belt from engine. Different sizes and styles made to suit all duties.

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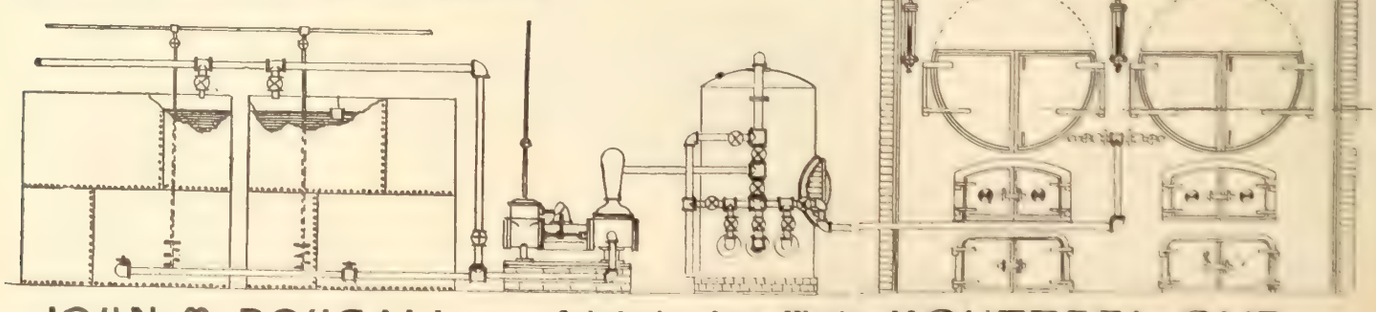
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CANADIAN

ELECTRICAL NEWS

AND

ENGINEERING JOURNAL.

VOL. XI. SEPTEMBER, 1901 No. 9.

EXHIBIT OF THE CANADIAN GENERAL ELECTRIC COMPANY.

To enter the Machinery Hall at the Toronto Industrial Exhibition was to admire the exhibit of electrical apparatus made by the Canadian General Electric Company. This was the first time in several years that the company have exhibited at the Toronto Exhibition, special arrangements having previously been made at their warerooms for the reception of visitors. Their exhibit this year was a valuable addition to the display in the Machinery Hall. It was located on the south side of the hall, where a pavilion had been built 120 feet in length. The names of the Canadian General Electric Company, and its associate company, the Canada Foundry Company, were attractively brought out in gold lettering on white background. The display of electrical apparatus ranged from the 150 k. w. S. K. C. generator to the 1½ k. w. 1 B. direct current generator; from the enclosed arc lamp to the miniature incandescent lamp. There was shown a 25 light constant current transformer, forming part of a complete system of series alternating current enclosed arc system of street lighting. The current was brought into the blue Vermont marble switch-board and thence to the transformer at 2,200 volts and then to the enclosed arc lamps hung about the exhibit. The effect produced when the lamps were lighted was most attractive and pleasing, and was the subject of much comment by visitors to the Machinery Hall. One of the C. G. E. type H. generators in operation was also shown, the current being utilized for incandescent lamps, fan motors, etc. A motor driving a sewing machine and electric cooking and heating apparatus of great variety were likewise exhibited, as was also a street railway truck made by the Canada Foundry Company and equipped with two G. E. 1,000 railway motors, while there were also some K controllers and other car equipment. Sample boards of supplies were arranged as four-sided pyramids on a pivot. The display also included a full range of lighting transformers from the smallest size to 10,000 watts, three massive air blast transformers, and almost everything in the line of electrical apparatus and supplies. The accompanying illustration will serve to show in a measure the general arrangement of the exhibit.



EXHIBIT OF THE CANADIAN GENERAL ELECTRIC COMPANY AT TORONTO EXHIBITION.

ROTARIES VS MOTOR-GENERATORS.

An interesting comparison of the relative efficiencies and cost of static transformers and rotary converters as against motor-generators receiving the 11,000-volt current direct into the motor, and converting it into 600-volt direct current by means of a generator coupled to the same shaft, is given in the following table, which is due to H. G. Stott, electrical engineer of the Buffalo General Electric Company:

	EFFICIENCIES — KILOWATT UNITS					
	Transformer.	Rotary.	Combined.	Motor.	Generator.	Combined.
Full load	97.5	93.0	90.67	95	92	87.4
¾ load	97.1	92.5	89.81	94	91	85.81
½ load	96.0	90.0	86.40	92	88.5	81.42

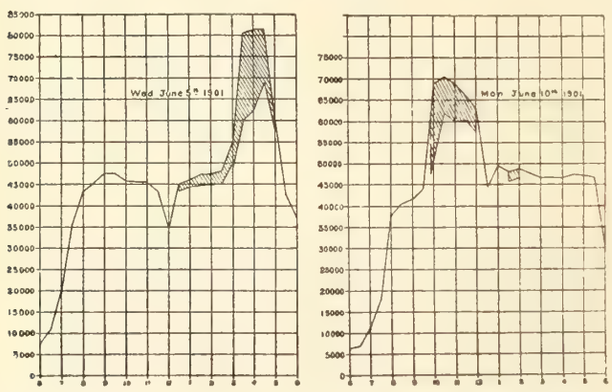
From the above table it will be seen, says the Journal

of Electricity, that the transformer and rotary converter give 3.27 per cent. at full load, 4.27 per cent. at three-quarter load, and 4.98 per cent. at one-half load better efficiency than the motor-generator set.

The investment shows a saving in favor of transformers and rotary converters of about 19. per cent., so that for purposes such as railroad work, where no great refinement of regulation is required, the rotary is beyond doubt the best and most economical.

STORAGE BATTERIES IN CENTRAL STATIONS.

Among the many problems which confront the manager of a central lighting station, one of the most troublesome, especially during the summer season, is that which is caused by the sudden load thrown on the station by a thunderstorm—the overcast sky causing thousands of lights to be turned on for a period of from half an hour to possibly several hours. This creates a peak for which no preparation has been made, necessitating firing up an extra boiler and starting additional generating units—all of which takes considerable time



FIGS. 1 AND 2.—CURVES SHOWING OPERATION OF BATTERY.

and possibly by the time steam is generated, the storm has broken, and the necessity for extra work has passed.

In no way can the usefulness of an installation of chloride accumulators be better shown, says the Electrical World, than in just such an emergency load, and the accompanying diagrams, which show their operation in the battery stations at the Chicago Edison Company on a dark day, are striking illustrations of the manner in which the battery "helped them out."

Fig. 1 is a curve showing the operation of the battery on June 5, 1901, and Fig. 2 that of June 10. Both of these curves show in the shaded portions the work done by the battery.

BY THE WAY.

The Great Northwestern Telegraph Company, of Toronto, are to be congratulated upon having succeeded in reaching an agreement with the city of Toronto, under which the amount of the assessment to be imposed on their property has been fixed for all time to come.

* * *

The firm hold that electric lighting has obtained on public favor is exemplified by the fact that in a number of the new dwellings now being built in Rosedale and other choice residential districts of Toronto, no gas-piping for lighting purposes is being put in. A single gas-pipe entering from the rear suffices to give the supply required for cooking purposes.

* * *

I am sometimes amazed at the character of the devices offered as substitutes for the electric ligh

While at the Toronto Industrial Exhibition my attention was attracted by a man with a large foot pump strenuously at work pumping air into a tank enclosed in the base of an ornamental iron lamp-post, from the top of which depended a glass street lamp. The contrivance was labelled "The Meriden Hydro Carbon Arc Light." I learned that the tank into which the air was being pumped also contained gasoline, and that the pumping-up process (which, by-the-way, appeared to be the hardest kind of work) had to be resorted to every 24 hours. I pictured to myself a town fitted with an outfit of this character, with a foot pump brigade to keep it in operation, and imagined how it would become the laughing stock of its neighbors, equipped with up-to-date electric lighting plants, with which it is only necessary to press the button to perfectly illuminate the streets, business places and residences. Until better substitutes are obtainable than those which are now offered, the electric light will continue to increase in popularity.

SUBMERGED MOTOR FOR ELECTRIC BOATS.

A small portable electric motor for propelling small boats is the novel device that is being manufactured by the Submerged Electric Motor Company of Menomonie, Wis. This propeller, says the Electrical World, is a combination of motor, propeller-wheel and rudder is occupies the place of the rudder, as shown in the accompanying illustration, and can be placed in position on any boat and exchanged from one to another in a very few complete and portable, weighing [illegible] It minutes.

The motor itself is under water, while the storage batteries are in such compact form that they may be placed out of the way, under the seats of any ordinary rowboat. The motor not only propels the boat, but steers it as well, the boat answering to it more readily than to an ordinary rudder. It is simple in construction, and is not liable to get out of order, it is said.

The motor drives the boat forward or backward, and can be regulated to run at any speed up to four miles an hour,



SUBMERGED MOTOR FOR ELECTRIC BOATS.

using two boxes of four cells, and will run from 20 to 30 miles on one charge. More cells may be used and a speed of six miles an hour attained, if desired.

The company's accumulators have an extremely large surface of active material and are capable of returning a large per cent. of the current with which they are charged. Each battery box containing two cells weighs about 50 pounds each, and is provided with a comfortable handle for carrying.

"It will easily be realized (without demonstration)," says the Submerged Electric Motor company, "that our motor being outside of the boat, and in the water, there is absolutely no strain or vibration, and on this account it is not necessary to build a boat of any extra strength or weight, in order to carry the power."

QUESTIONS AND ANSWERS

"SUBSCRIBER": Would like to know if you can give me a pointer in preventing T. H. arc machines from flashing. All adjustments are made according to manufacturer's pamphlet, blower apparently runs well, ammeter steady, but still the machine will flash. Have tried everything I can think of, but of no avail.

ANS.—The most likely source of your difficulty is that the brushes are not correctly set. A very slight movement will make a tremendous difference in their operation. Again, the blower, though apparently working well, may not be delivering the blast onto exactly the right spot; twisting it slightly may get you over the trouble, or yet again the trouble may be in the lamps, which may be feeding irregularly enough to affect the operation of the machine, and yet not show on the ammeter. An overload will sometimes cause this type of machine to flash, as will a speed appreciably below normal.

"SUPERINTENDENT": What are the main points in choosing between glass and porcelain insulators for a transmission line?

ANS.—The making of a definite choice between these two materials is a difficult matter, as each has certain advantages not possessed by the other; again, each is free from certain objections to which the other is subject. For transmissions through unoccupied territory not easily patrolled, glass is objectionable on account of its brittleness, as the insulators are found to suffer from being used as targets by passing gunners. A porcelain insulator when hit will chip off only at the point struck, the remainder still holding the line in place. A glass insulator on the other hand will shiver to pieces and drop the line unto the cross arm; again, as far as the actual insulation goes, porcelain is not as hygroscopic as glass, i. e., will not condense moisture as readily on its surface. On the other hand, glass is considerably cheaper, and flaws or cracks can be detected by the eye, whereas with porcelain they have to be tested for. The general concensus of opinion seems to be, that as far as experience goes to-day, glass is perfectly satisfactory up to potentials of about 4,000 volts, above that porcelain is more generally used, though glass is in successful use in isolated cases for potentials far exceeding these figures.

W. E. ARMSTRONG, London: Will you kindly answer through your "Questions and Answers Department" in the ELECTRICAL NEWS the following questions: 1. To what class or type of arc dynamos does the machine known as the "Reliance" and used so much in Ontario, belong? 2. Will you give a diagram or explain the connections of the Reliance automatic switchboard? 3. Is there any rule for determining the potential difference between the carbons of an arc lamp—the current strength of the circuit being known as a matter of course?

ANS.—1. To the closed coil Gramme ring type, as distinguished from open coil armatures, or those with a drum type of winding. 2. We regret that we have no information available on this type of switchboard, though we are under the impression that its principal feature consisted of automatic jacks which were arranged so as to permit the charging of circuits from one machine to another without disturbing the operation of the lamps, but perhaps some of our readers can give you more definite information. 3. The voltage across an arc is governed by the same laws as all other drops of potential in electrical circuits, namely, E, (the arc voltage) = C (current) times R (impedance or resistance) of that part of the circuit under discussion. This latter figure is, of course, difficult to measure, varying with the size and separation of the carbons, the amount of current passing, and in alternating circuits, with the frequency. It is usual to so adjust open arc lamps, of capacities not exceeding 10 amperes, that the arc voltage shall be between 40 and 45. Higher amperages usually run with a lower arc voltage. With enclosed lamps on 110 volt circuits the figure varies between 70 and 75 volts; for 220 volt lines 140 to 150 is the usual value.

"J. F:"—How many lamps can be run from a horse-power?

ANS.—A horse power consists of 746, or say 750 watts, and as we presume you purpose to use a 16 c. p. 50 watt lamp, the lamps per horse-power are obtained by dividing 750 by 50, which gives 15. It should be noted that this method of calculating does not make any allowance for losses in either outside or interior wiring, nor for those occurring in transformers, which will have to be reckoned with should the system be alternating, and the amount of 15 reduced by a percentage the same as the sum of all the losses, or in other words for a total of 8 per cent. loss in transformers, line and interior wiring, you would be able to light but 92 per cent. of 15 or 13.8 lamps per horse power. The same reasoning holds true for lamps of higher or lower efficiency than 50 watts per 16 candles, a 45 watt lamp giving 50/45 of 15 or 16.6, and a 60 watt 50/60 of 15, or 12½ lamps per horse power.

"STUDENT": What is the method used for determining the loss of potential in street railway circuits, taking into account both the overhead copper and the rails?

ANS.—The ordinary formula of $E = \frac{11CD}{\text{cir. mills.}}$, E being the volts lost, C the current in amperes, and D the distance (one way) in feet, holds good for the overhead or copper part of the line. The track is somewhat more difficult to estimate, the result obtaining varying with the size of the rail and the style and condition of the bonds, but the constant for the rails varies from .2 (being for exceptionally good track) to .8 (very poor track) of the above copper constant of 11, the result for average work being a combined constant of 14.5, which is the figure generally used when figuring on rails of about 70 lbs. per yard, the bonds being in good condition.

"W. J. K.": Will you kindly advise me the power which I will require to drive an 8-foot boring mill, a 60-inch planer, and a 72-inch lathe?

ANS.—The above machines, under the usual conditions, will respectively require about 4, 10 and 4 horse power delivered to each, though obviously these figures will vary considerably with the cutting speeds, the material and the size of the cut, except in the case of the planer, where the maximum power consumption is governed principally by the relative speeds of the cutting return strokes, as when reversing to return the machine will call for one and one-half to three times its average power demand.

CANADIAN ELECTRICAL NEWS AND ENGINEERING JOURNAL

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Advertising rates sent promptly on application. Orders for advertising should reach the office of publication not later than the 28th day of the month immediately preceding date of issue. Changes in advertisements will be made whenever desired, without cost to the advertiser, but to insure proper compliance with the instructions of the advertiser, requests for change should reach the office as early as the 26th day of the month.

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The ELECTRICAL NEWS will be mailed to subscribers in Canada, or the UnitedStates, post free, for $1.00 per annum, 50 cents for six months. The price of subscription should be remitted by currency, registered letter, or postal order payable to the C. H. Mortimer Publishing Company of Toronto, Limited. Please do not send cheques on local banks unless 25 cents is added for cost of discount. Money sent in unregistered letters will be at senders' risk. Subscriptions from foreign countries embraced in the General Postal Union $1.50 per annum. Subscriptions are payable in advance. The paper will be discontinued at expiration of term paid for if so stipulated by the subscriber, but where no such understanding exists, will be continued until instructions to discontinue are received and all arrearages paid.

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Correspondence is invited upon all topics coming legitimately within the scope of this journal.

The "Canadian Electrical News" has been appointed the official paper of the Canadian Electrical Association.

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The Canadian Electrical Association.

The Secretary of the Canadian Electrical Association has received through Mr. A. A. Dion, immediate past president, a cheque for $100, being a refund of two-thirds of the amount voted by the Association for entertainment purposes in connection with the annual convention held in Ottawa last June. Mr. Dion states that the Committee are pleased to find themselves in a position to make this refund to the funds of the Association. The thanks of the members are certainly due the Committee and the citizens of Ottawa for their generosity in providing almost entirely at their own expense the splendid programme of entertainment enjoyed by those who attended the convention.

Niagara Power

In the light of the oft repeated statements in the daily press that arrangements are being made to transmit electricity for the generation of commercial light and power from Niagara overland to Toronto, it is interesting to note the opinion of Thos. A. Edison reported as having been expressed in a recent interview, that the thing can't be done. When asked "Why?" Mr. Edison's laconic reply was "no money in it." This is the crux of the whole matter. If it can be shown that there is money in the undertaking it will certainly be carried out, otherwise not. The opinion prevails that the recent rise in the stock of the Toronto Electric Light Co. has some connection with the project to transmit current from Niagara, but the evidence to substantiate the theory is not yet forthcoming. The Journal of Electricity, of San Francisco, approves of the views of a writer in the Saturday Post, of Philadelphia, who predicts that the immense body of water constantly passing over Niagara, will eventually be employed to drive electrical machinery, leaving nothing to the tourist but a bare wall of rock, and that in like manner the minor water falls throughout America will disappear.

The Toronto Industrial Exhibition.

Notwithstanding the counter attraction offered by the Pan-American Exhibition, the number of exhibits at the Toronto Industrial Exhibition was as numerous as in former years. In live stock the exhibits were considerably greater, and the stable accommodation proved inadequate. The number and quality of the electrical exhibits which are more fully described elsewhere, was in advance of any previous year. The conclusion seems justified that the success achieved this year under adverse circumstances, might be greatly amplified if the Main Building and several of the other important ones, were replaced by modern structures designed to fulfil in a more perfect manner the requirements of exhibitors. That there is need for reform in the management is shown by the fact that after the opening of the Exhibition this year the roof of the Main Building leaked like a sieve. In consequence many of the exhibits were seriously damaged. The management should have known that the roof was defective, and the necessary repairs should have been made before the Exhibition opened. It would be unwise, however, to spend any considerable sum for repairs as the building is no longer capable of fulfilling the requirements. The support that has been given the Exhibition in spite of its many defects, is a guarantee that if properly managed it will develop into an enterprise of vastly greater importance in the future.

There were to be seen this year a number of exhibits from the United States in addition to those of Canada, a proof that the value of the Exhibition as a means of advertising is becoming more widely recognized. The presence of these foreign exhibits side by side with those of our own country, affords opportunity to make comparison between the quality of home and foreign productions. As a rule the result is a higher appreciation of the home article.

A Suggestion

It may not be out of place to suggest to electrical companies the wisdom of cultivating the good will of the citizens of the municipalities in which they do business. Some companies have followed the unwise plan of doing about as they pleased regardless of the wishes of the citizens. Such a course is certain to react injuriously, not only upon the individual company, but upon all companies similarly situated.

The Telephone Abroad.

A municipal underground telephone system has just been put in operation in Glasgow. The system covers 16,500 miles, provides for 20,000 subscribers, and is designed to give cheap and convenient communication. As the result of public dissatisfaction with the service and charges of the National Telephone Company, a movement is said to have been started with the object of installing in the leading cities of Great Britain under municipal control systems similar to the one which has just been inaugurated in Glasgow. A re-organization of the Australian system is also proposed, the switchboards and other appliances at present in use being out of date, and consequently inefficient. A conference of leading electrical engineers of Australia has been appointed to suggest what steps should be taken to reorganize and standardize the system.

The Nernst Lamp.

In a paper read before the American Institute of Electrical Engineers, Mr. A. J. Wurts gave a most complete history of the development of the Nernst lamp in the United States. The facts presented by Mr. Wurts have been received by the electrical fraternity with a great deal of satisfaction, and have, it would seem, created a more favorable impression of the lamp than had previously existed. The development of this type of lamp so far would seem to place it in the rank of a competitor to the arc rather than the incandescent lamp. Compared with the incandescent lamp, it is more complicated, requires to be cleaned at regular intervals, and is expected to be relatively much higher in cost. In the United States the smallest Nernst lamp yet manufactured is of 50 candle-power. The superiority over the incandescent lamp is said to be in color and efficiency only. A more favorable showing is made in comparison with the arc lamp. The Nernst lamp is reported to be steadier in action, about equal in price, and capable of being operated directly from 220-volt mains without the insertion of several lamps in series, and also of being adapted to trolley-car lighting. A further advantage claimed for it is that it may be operated on low frequency circuits. It is also well adapted to the purposes of general illumination and decorative interior lighting. If in commercial use the Nernst lamp is found to be all that is claimed for it, there is no doubt that it will meet with favor in some particular field, but is not likely to replace entirely even the arc lamp. Referring to the progress of the lamp in Germany, Mr. E. Kilburn Scott, in the Electrical World, says: Hitherto the cost of manufacture has kept the new lamp from being a commercial success, and now this is in a fair way of being solved. In the A.E.G. works the lamps are extensively used, and they are also employed by many private consumers, to whom a rental of 75 cents per annum per lamp fixed is charged, there being nothing extra to pay for the renewal of the filament. To buy outright the price is $1.67 and 50 cents for each extra filament. The lamp is made for any voltage up to 250, and the fluctuatiou of pressure which has such a detrimental effect is taken care of by a special device in the latest type of lamp. The pleasing effect of the lamps was abundantly manifested to all the members present, and the ladies seemed to be especially impressed by the fact that by gently blowing on the filament the light could be put out. Of the economy of the lamp over an ordinary incandescent lamp the A.E.G. have now accumulated overwhelming evidence, as well as the very interesting fact that the efficiency of the lamp is maintained practically constant throughout its life."

Storage Batteries.

Storage batteries are quite a feature of the Pan-American Exposition. Edison's storage battery, which is on exhibition, has naturally been examined with much curiosity. The one exhibited is of ⅛ horse power, 100 ampere-hours, and weighs 5¾ pounds. The cell is of steel, nickel plated. The negative plate is of nickel and the positive of iron. The fluid is not an element of the battery, it being used simply as a conductor. In the ordinary construction of the batteries, 60 plates will constitute one horse power, each plate weighing one pound. It is understood that Mr. Edison has withdrawn his battery from competition with other batteries, probably for the reason that he is not yet prepared to make public what are as yet secrets of the laboratory in connection with the battery. The Gould Storage Battery Company are exhibiting what is said to be the largest storage battery cell yet constructed. It has fifty positive and fifty-one negative plates, 15½ x 31 inches. The rating of the cell is 2,000 amperes for 8 hours discharge, and it is shown in actual operation, A switchboard with sufficiently heavy conductors and a small motor driven dynamo of 2.6 volts E.M.F. are provided for charging.

MONTREAL LIGHTING CONTRACT.

The lighting of the streets of Montreal has recently engaged the attention of the city council. The present contract with the Royal Electric Company expires on the 31st of December, 1903, and is at the rate of $120 per arc light of 2,000 candle power. Tenders were invited in June last for the future contract. The figures submitted were as follows: Royal Electric Company, $95 per light per annum; Lachine Rapids Hydraulic & Land Company, $90 per light; Standard Light & Power Company, $99 per light, all for a five or ten year contract, Imperial Electric Light Company, $85 per light for a five year contract, or $80 for a ten year contract; Shawinigan Water & Power Company, $79.93½ for a five year contract, or $78.47½ for a ten year contract; St. Lawrence Power Company, $54.75 per light for a five year contract. At a meeting of the council in July, a motion to award the contract to the lowest tenderer was voted down, and it was decided to postpone consideration of the question until September. On the 3rd inst. the council, by vote of 18 to 15, decided to give the contract to the Royal Electric Company at $60 per lamp per annum for a term of five years.

EXHIBITS AT THE TORONTO INDUSTRIAL EXHIBITION.

Reference is made below to the exhibits of our advertisers at the recent Toronto Industrial Exhibition:

The oldest firm in the belting line in Canada is the J. C. McLaren Belting Co., who have been established for 45 years, with offices in Toronto, Montreal and Vancouver. This firm had an extensive exhibit of genuine English oak belting in the Machinery Hall, Mr. J. E. Stephenson, Ontario representative, being in charge.

F. E. Dixon & Company, Toronto, exhibited oak tanned leather belting. This firm are also agents for S. E. Norris & Company, of London, England, and showed samples of Warren's pulley cover, which is applied with a brush, and which it is claimed will stop all slipping of belts.

D. K. McLaren, of Montreal and Toronto, showed a good display of genuine oak belting, as well as the Lancashire hair belt. Mr. E. Richardson, Toronto, was in charge of the exhibit.

The Dodge Manufacturing Company, Toronto, had a fine exhibit of wood-split pulleys, Dodge system of rope-driving, friction clutch pulleys and couplings. They also showed an automatic car shovel and automatic safety car puller used for pulling cars, with a capacity of from five to eight cars, a mule stand used for belt-driving around corners and angles, and a jack shaft and quill fitted with Dodge split friction clutch.

The Waterous Company, of Brantford, Ont., exhibited two high-speed McEwen engines, one 50 h. p. and the other 150 h.p. This engine is especially adapted for driving electric light dynamos.

The Canada Brass & Electrical Company, Limited, of Toronto, showed dynamos, generators and lamps, also an improved motor.

The Hardill Compound Engine Company, of Mitchell, Ont., had on view a 50 horse-power Hardill engine. This engine is a model of economy, strength, and simplicity. It is claimed to be constructed along different lines than any other compound engine, and is fully protected by letters of patent. Instead of two valves, each operating attached to two separate cylinders, this has two steam chests, both of which are connected with the two cylinders, and situated midway between the high and low pressure, the valves being operated by two separate eccentric rods.

The Northey Company, Limited, Toronto, had a large exhibit, and showed a line of steam pumps for boiler feeding and water works and other purposes, also gas and gasoline engines in full operation.

The Gould, Shapley & Muir Company, Limited, of Brantford, had a large and varied display of gas and gasoline engines, a feature of this exhibit being the unique arrangement according to the size of the engines.

The Jones & Moore Electric Company, of Toronto, had a fine display of electrical machinery, illuminated with a variety of colored lights.

The Goldie & McCulloch Company, Limited, Galt, Ont., showed a 100 h.p. Wheelock engine in operation running the north line of shafting, 80 h. p. Ideal engine also operating the south line of shafting and several of the electrical exhibits; fast feed flooring machine; 4-sided 12 inch moulder; 26 inch smoothing planer; Nos. 1 and 2 shapers; 12″ and 16″ Buzz planer; 2 spindle boring machines; lot of wood rim split pulleys; new self feed rip saw table; 6″ sash sticker; 10 h.p. gasoline engine; 4 h.p. gas engine; 3 h.p. gasoline engine; Emery chopping mill, etc.

The United Electric Company, of 134 King west, Toronto, made an attractive exhibit of machines and apparatus of their own manufacture. The dynamos exhibited ware arranged and operated as under the usual working conditions; in fect, the whole exhibit was a practical working plant. There were shown the largest direct current Multipolar generator ever exhibited at the Industrial Exhibition. This machine, of a capacity of 200 horse-power, operated long burning arc lamps, incandescent lamps, and motors, all of 250 volts. Connected to the circuit were lamps intended for street and commercial lighting, of plain and ornamental finish, and guaranteed to burn 200 hours with one carboning. Other machines shown were inductors, alternators, and induction motors, transformers, multipolar and bipolar dynamos and motors, switch-boards, and several arc dynamos.

MOONLIGHT SCHEDULE FOR OCTOBER.

Day of Month	Light.	Extinguish.	No. of H.
	H.M.	H.M.	H.M.
1....	6.15	P.M. 9.40	3.25
2....	6.15	10.30	4.15
3....	6.15	11.30	5.15
4....	6.15	0.30	6.15
5....	6.15	1.45	7.30
6....	6.00	2.45	8.45
7....	6.00	3.45	9.45
8....	6.00	4.45	10.45
9....	6.00	5.30	11.30
10....	6.00	5.30	11.30
11....	6.00	5.30	11.30
12....	6.00	5.30	11.30
13....	5.45	5.30	11.45
14....	5.45	5.30	11.45
15....	5.45	5.30	11.45
16....	5.45	5.30	11.45
17....	7.00	5.30	10.30
18....	8.00	5.30	9.30
19....	9.00	5.30	8.30
20....	10.00	5.45	7.45
21....	11.00	5.45	6.45
23....	A.M. 0.10	5.45	5.35
24....	1.00	5.45	4.45
25....	2.30	5.45	3.15
26....	No Light.	No Light.	
27....			
28....			
29....	P.M. 5.30	A.M. 8.30	3.00
30....	5.30	9.30	4.00
31....	5.30	10.30	5.00
	Total....		157.30

CANADIAN WATER POWERS.

There is another big power scheme which will soon be brought before the Provincial Government at Toronto, Ontario. It aims to develop the water power northwest of the town of Port Arthur, Ont. The capitalists behind the scheme figure out that on the completion of the Canadian Northern Railway, Port Arthur will become a great flour milling centre. They have in consequence set to work buying land for a canal 22 miles long to connect with and divert the Kiministiquia River. There is said to be an easy route between the high levels to a point 3½ miles north of Port Arthur, where the syndicate proposes constructing a reservoir with an area of 1500 acres. When the route has been secured, it is not expected that much influence will be required to ensure the water power of the river in West Algoma being quietly conceded by the Ontario Government to a company.

DYNAMO ILLS AND REMEDIES.*

A dynamo or motor, carefully installed and properly running, is truly a thing of beauty to those who have the care of it, and a source of satisfaction to its owner. Trouble, however, in one form or another is sure to come sooner or later, depending on the grade of the machine and the skill and care in handling.

It is therefore likely that a few hints as to the cause and remedy of such troubles will be acceptable to those who have the care of this class of machinery.

Obviously, the promptness with which such troubles are located and removed will have much to do with the success of the plant. Often, indeed, considerable expense is incurred in removing a fault, which with a little intelligence could have been remedied at trifling cost.

For instance, so slight a thing as a loose connection will often cause the shutting down of a whole factory with scores of hands. Other troubles equally as simple but not so easily located will cause annoyance and delay. In such cases, some knowledge on the part of the man in charge in locating troubles would have enabled him to overcome the difficulty and save delays and consequent loss.

Fortunate it is that the machines in question are mechanically so simple in their construction. With the exception of cummutator and brushes there are but two wearing parts, the two bearings which support the shaft of the armature, quite in contrast in its simplicity to the steam-engine with the multiplicity of wearing parts, oil cups and valves.

From the fact that the dynamo or motor has so few parts, we are able to classify their troubles through their effects under five heads, which are :

1. Sparking at cummutator.
2. Heating of the various parts.
3. Noise and speed.
4. Motor stops or fails to start.
5. Dynamo fails to generate.

Any and all of these effects are quite obvious, even to the casual observer ; still a most careful and thorough examination should be made of the entire machine in order to be sure of facts and avoid jumping at conclusions.

In the consideration of troubles as classified above the following order will be observed : First, the cause ; second, the sympton in detail ; third, the remedy and how effected.

As is very often the case, a symptom may be developed in a machine from several causes. We shall, however, endeavor to make the distinction as clear as is possible without the help of the actual machine for illustration.

Sparking at the commutator is caused, first, by the armature carrying too much current, due usually to an overload ; in the case of the dynamo, too many lamps in circuit ; or in the case with the motor, excessive frictional load, from hot bearings, armature striking the pole pieces, belt too tight, or in general, too much mechanical work to be done. Excessive voltage on constant potential circuits will also overload the system.

The symptoms are continuous sparking at the commutator during the time of maximum load and tendency to slipping of the belt.

*From the Journal of Engineering.

After a continuous run, the armature becomes very much overheated and will burn out if the load is not lightened.

In this, however, there is an exception, constant current arc motors. As the heating effect depends on the square of the current multiplied by the resistance ($C^2 R$), both of which factors are constant in this instance, it is quite possible to overload machines of this type till the armature stops without risk of burning it out.

Excessive friction load is readily detected by turning the armature around by hand.

Hot bearings will be treated more in detail under the head of heating of the various parts.

An excess of current is, of course, at once evident at the ammeter, and this may be taken as a conclusive test for all such overloads.

The remedy, for troubles of this nature, is obviously to reduce the load and eliminate partial short circuits in the line and leads as far as possible.

Constant potential motors, especially those above five horse-power, are frequently subjected to overloads and strain at starting.

If the starting-box has too little resistance or is turned on too rapidly, it will cause the armature to start with a jerk and spark badly at first. A properly designed starting box will remedy the evil in the first instance, and in the latter case, the exercise of proper care in starting. The handle of the starter should be allowed to remain an instant on the first and second contact points till the armature has attained some speed.

Again, brushes are sometimes not set at neutral points. The symptom of this trouble will be a sparking and cutting at the commutator, the intensity of which will vary with the shifting of the brushes.

The remedy can best be explained by referring to Fig. 1, which shows the proper position of the brushes. The points where the brushes are resting on the commutator where the greatest E.M.F. and the least sparking are obtained, are called the neutral points, as represented in the cut by the points "A" and "B."

The line joining these two points has been termed the diameter of cummutation. It will be noted that this line is not at right angles to the line joining the centers of the pole pieces, but is shifted through a small angle, depending on the direction of rotation and

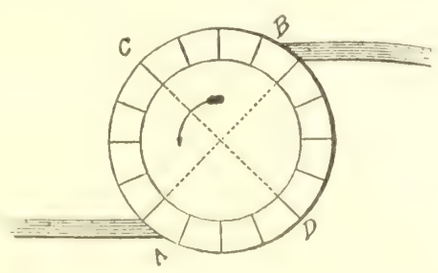


FIG. 1.

The Diameter of Cummutation.

whether the machine is acting as a dynamo or motor.

With the dynamo, the brushes will be given a forward lead, that is, they will be shifted from the horizontal in the direction of rotation.

With the motor, the shifting of the brushes will be against the direction of rotation and will be given what is termed a backward lead.

In most dynamos and motors the exact position of the neutral points cannot be fixed, but will vary accord-

ing to the load of the machine. For instance, in case of a dynamo with a given number of lights burning, the brushes may be properly set at the neutral points and run without sparking. Now let the number of lights burning be increased or diminished to any considerable extent and sparking, more or less destructive, will commence and continue till the brushes have been shifted to the new neutral points by means of the rocker arm. These points are determined only by trial.

This shifting of brushes, or giving them a lead as it is called, is necessitated by armature reaction or the magnetizing effect of the current in the armature, tending to create a powerful magnetism which distorts the field.

Right here we will state that there are some dynamos and many motors in which it is not necessary to shift the brushes, no matter how much the load changes. In these the field has been made strong enough to overpower the armature reaction. Again in another class of dynamo, the moving of the points of contact is taken advantage of as a method of increasing or decreasing the E.M.F. This is the case of constant current arc machines.

It is not only necessary to shift the brushes to the neutral points by means of the rocker arm, but care should be taken to see that the brushes are diagonally opposite each other. This can be accomplished by counting the number of segments of the cummutator, measuring with a piece of thread or other device, marking the opposite segments, and setting the brushes to this mark.

The setting of brushes is perhaps the most important

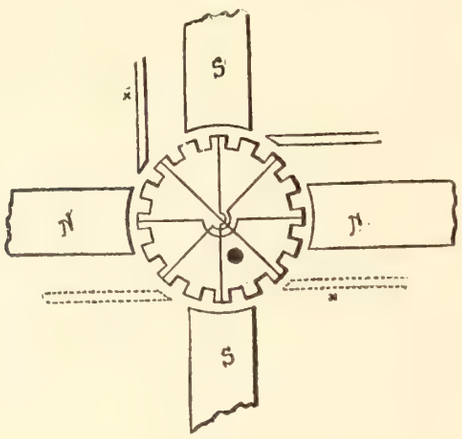


FIG. 2.
Circuits of Cross Connected Armature. Four Poles; Two Brushes.

duty of the dynamo tender, for a brush, a fraction of a segment out of position, will often cause serions sparking.

Exceptions to the rule for setting brushes diametrically opposite will appear in the case of multipolar motors with cross connected armatures.

These machines may be supplied with two sets of brushes or as many sets as there are poles. For instance, four pole machines with two sets of brushes require them to be set at 90 degrees apart; 6 pole at 60 degress, or 180 degrees, and so on.

Fig. 2 shows the armature connection and the position of the brushes in a four pole machine with cross connected armature. The arrows mark the direction of the current in the armature connection. It is apparent, therefore, that no one should attempt to set the brushes on such a machine without first determining from a blue print or other source their correct position, and then keeping them there.

Should the brushes be set very far out, they will probably cause the safety fuse to blow and in the case of a dynamo it will fail to generate.

The commutator may have high bars or low bars due to loose shell or an unusually hard specimen of copper.

A poor connection between the leads and the tongue of the commutator segment, will also develop a flat,

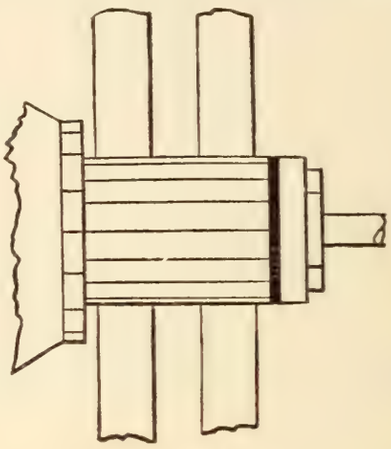


FIG. 3.
Commutator in Good Condition.

hard mica between the segments which does not wear down as fast as the copper; all of these produce a rough commutator.

The sympton in this case will be a chattering of the brushes, accompanied by sparkling, which is sometimes apparent by the sound. By touching the commutator with the top of the finger the least roughness is at once apparent. Turn the armature slowly by hand when any eccentricity will be indicated by a rise and fall of the brushes.

The commutator as it should be is represented in Fig. 3, with brushes properly set and the surface of the commutator smooth and glossy.

Accompanying is a sketch of the same commutator in bad condition. The commutator being scarred and rigid and the brushes badly set.

In cases where the commutator exhibits eccentricity or is deeply cut, the armature should be taken out,

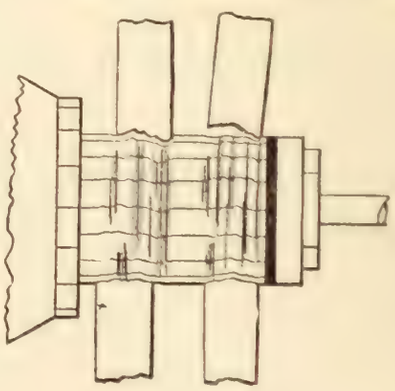


FIG. 4
Commutator in Bad Condition.

accurately centered in a lathe and the commutator turned off, taking off as light a chip as possible.

In large armatures it is often more convenient to rig up a special slide rest and turn off the commutator while the armature is turned at slow speed in its own bearings.

A loose bearing will also cause chattering of the

brushes with the attendant sparking and cutting of the commutator. If the bearings are loose and worn they should be re-babbited or new ones put in. A slide rest which clamps on to the pillow block in place of the rocker arm is shown in Fig. 6.

A slightly rough commutator can be dressed down with a fine file and given a final application of fine sand paper, the armature being turned at medium speed.

If the machine in question is a dynamo it is advisable to raise the brushes, start the engine at medium speed and apply the file or sand paper, or both, as the case may be, thus avoiding clogging the brushes with dirt and copper dust.

With a motor it is different, as we must rely on the current to turn the armature. It is therefore an exceedingly dangerous practice to use a file, although sand paper may be applied without danger. It is a good plan to put a little oil on the sand paper, for in this way the particles of copper are gathered and prevented from flying into the armature, thus increasing the danger of short circuits or burnouts.

It may be stated as an axiom that copper-dust and metal filings in general should not be allowed to collect about a dynamo or motor. For this reason emery cloth should never be used on the commutator, as the particles of emery are so sharp they become lodged in the copper of the segments, thus converting the commutator into a veritable grinding tool. Again the particles get into the mica and cause short circuits.

Brush-holder screws sometimes become loose and the brushes get tipped up so that they touch only at one point. Very often vaseline or oil has been applied too freely and the commutator has become dirty. The springs which give tension to the brushes may have lost their temper from carrying the current, though this is an indication of a faulty design of brush holder. The bearing part may have been clogged for some reason so that the holder does not work freely—though the spring may still be good. Hard carbons that will not

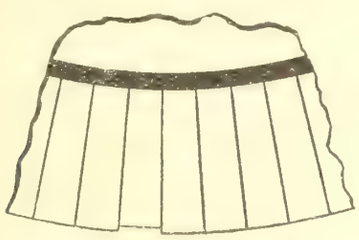


FIG. [illegible] A LOW BAR.

adjust themselves in wearing to the commutator, and which sometimes offer exceedingly high resistance, also induces sparking at the commutator.

Copper brushes can best be filed for adjustment to the commutator in a jig made for the purpose.

The simplest way to adjust carbon brushes is to first wrap a piece of sand paper around the commutator, having the rough side of the paper turned out; then set the carbon brushes down tightly against this surface, revolving the amature by hand while the brushes will be rapidly and accurately shaped to the surface.

The best way to keep a commutator clean is to wipe it at intervals with a piece of cotton cloth or felt slightly moistened in vaseline.

A motor with short circuited coils or bad grounds will draw excessive current, even though running free of load. A dynamo will require considerable power though there is no evidance of power in external circuit; in either case violent sparking will result.

The sympton most apparent will be a heating of the coil or coils affected, and the attendant will become warned of the danger by the odor of the burnt cotton insulation.

A short circuited armature coil often results from allowing copper dust to collect back of the commutator or when excessive sparking of the brushes has formed little bridges of metal across adjacent commutator segments.

Short circuits in parts of the coils of an armature frequently occur from injuries to the insulation, from external mechanical sources, for instance, the dropping of little particles of material in the spaces between the armature and the pole places while the armature is in

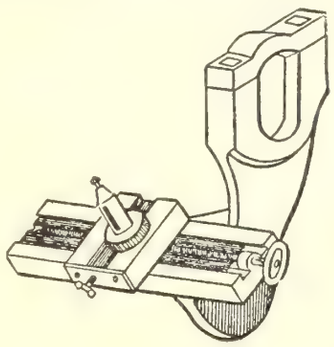


FIG. 6.

A Tool Clamping on Pillow-Block Used to Turn off Commutators.

motion. A screw, for instance, or even little balls of waste, and more frequently oil and dirt, cake on the faces of the pole pieces, scraping the insulation off the wires.

A piece of iron, a screw-driver or key, for instance, held between the field magnet, near the revolving armature, will vibrate very preceptibly as a short circuit coil passes.

In the case of a motor, an armature affected with a short circuited coil will revolve slower than usual and unsteadily, while in aggravated cases it will draw up with a jerk before the pole piece.

Ills such as those described as short circuits due to deposits of copper dust back of the commutator or the bridging over the segments from sparking may be located by careful inspection and removed by scraping clean the mica insulation between the segments.

Short circuits, due to mechanical injury to the insulation of the wire of the armature, require careful handling, as these injuries generally extend before the first layer of wire.

In most cases it is possible to carefully lift the wires, one at a time, high enough to wrap it with silk tape.

Wires thus raised and insulated must be carefully pounded back into place with a wood block or mallet, the affected part being then treated with a coating of shellac.

A short circuit which is in the coil itself and below the surface cannot be treated thus and the only real remedy is to rewind the coil.

Two or more grounds in an armature, occurring usually from insufficient insulation on the core, are equivalent to a short circuit and must be treated in the same way, viz., by re-insulating and re-winding the armature.

The commutator will flash violently when the broken coil passes under the brush, and it will be found that

the mica, surrounding the segments attached to the broken coil, will be blackened and burnt and gradually pecked away.

This break will often be found in the leads where the armature wires connect with the commutator, as in some types of machines they are subject to heavy drag. Usually they can be easily repaired by splicing.

An overload may cause the soldered connection of the leads to the commutator to melt and thus develop a break. The only avialable remedy is to solder in the leads again and guard against overload in the future.

Care must be exercised in the the soldering process lest drops of molten solder drop in behind the commutator and short circuit some of the segments.

When the trouble cannot be so easily located and is evidently in the interior of the coil, the coil thus affected will heve to be rewound.

The trouble, however, may be temporarily remedied by cutting out the coil, either by bridging over the disconnected segment with a drop of solder or by staggering the brushes, as it is called, that is, setting one of a pair a little ahead and the other a little back of the normal position, which is equivalent to bridging over the break.

In adopting teis method, care must be taken not to short circuit a sound coil, as this will cause sparking and a dangerous heating of the affected coil.

These devices are at best only "make shifts" and sholud only be adopted to prevent a very undesirable stoppage.

Field troubles cause sparking at the brushes and are of two kinds, open circuits and short circuits.

A dynamo thus afflicted does not generate at all or does not come up to its full electromotive force. The pole pieces are not strongly magnetic.

A constant potential motor has a tendency to race unless the field is very weak or is lacking altogether, in which case it may be either run slow or stop and blow the fuse.

The cause for such trouble is usually a broken circuit or a partial short circuit in one or both of the fields.

In order to test for an open circuit in the field of a motor, block the brushes up from the commutator with pieces of wood or paper, then turn on the current, remove the field wire from its binding post and absence of spark at the breaking of the circuit will indicate a complete break somewhere in the circuit.

In cases of field trouble in isolated dynamos where current is not obtainable, it will be necessary to remove terminals of the field circuit from their binding post and ring through it with a magneto or bell and battery.

Short circuits in field coils may be determined by measuring, with the proper instruments, usually a portable bridge and galvanometer, the resistance in each magnet coil. Any appreciable difference in the resistance of the magnets will indicate that the one of least resistance has been short circuted.

A machine thus affected will spark more at one brush than at the other when running, and it will further be noticed that the short circuited magnet will heat less than the sound one, which in turn will be above the normal.

The remedy for such troubles is to remove the faulty magnet and unwind the wire on it till the break or ground is found, when the fault may be repaired and the wire wound back again.

It may be stated here that a frequent cause of short circuits in field magnets and armature is due to the soaking they receive from oil thrown out by faulty bearings.

Oil, soaking into a field, seems to have the effect of rotting the insulation on the wire and a short circuit or ground is the result.

A carbon brush of high resistance may cause sparking because of its poor contact with the commutator. A charring or burning of the brush about the edges will be noticed and the brush itself becomes hot, in which case supply a softer brush.

Again, vibration in the machine due to insufficient foundation is frequently a cause of sparking. It will be found to decrease when the machine is braced. Often nothing more is needed than a slight increase in the tension of the brushes. The better way, however, is to secure the machine firmly to a good substantial foundation of masonry.

A chattering of the brushes is sometimes due to a dirty and sticky condition of the commutator. This is apt to be the case with radial carbon brushes. To remedy this wipe the commutator clean and then lubricate it with oil or vaseline rubbed on with a piece of cotton cloth or felt.

A trouble to which the same armatures are liable, and which is sometimes very difficult to locate, is what is termed a flying break.

This will develop after the armature is in motion, causing violent sparking with every indication of an open circuit, but will not be apparent to tests made when the armature is stationary. It can usually be found by careful inspection of the back and can be repaired with thoroughly good soldered joints.

SPARKS.

Mr. Ormond Higman, C.E., chief of the Electrical Inspection Department of the Dominion Government, has established an inspection office at Charlottetown, P.E.I., in charge of Mr. J. H. Bell.

The arbitration proceedings to fix the valuation of the plant of the Kingston Light, Heat & Power Company, at Kingston, Ont., are likely to be completed very shortly. It has been brought out that the plant has cost the company $131,220.80. The company pays a yearly rental of $12,252.37, and in 1900 the receipts were $58,820.08, with an expenditure of $51,[illegible]48, leaving a balance of $7,737.50.

A new company has been formed in Montreal, known as the Dominion General Engineering Company, Limited, to manufacture the Tree rotary engine, the invention of Mr. E. B. Tree and Dr. Taylor, of Princeton. This engine was for a short time manufactured at Woodstock, Ont. The company will have a capital of $500,000, and includes Messrs. J. W. Greenshields, K. C., and W. H. Lawrie.

The Snoqualmie Falls Power Company, of Seattle and Tacoma, has placed an order with the Pittsburg Reduction Company for 250,000 lbs. of aluminum wire cable, which will more than double the capacity of their transmission system. Co-incident with this the enlargement of the generating station at the head works is under way, and an additional pen stock will be installed, having 50 per cent. more capacity than the first one. This penstock will feed three waterwheel sets, each one of which will drive a direct connected 5,000 hp. generator. The underground cavity will be extended eastward about 150 ft. to accommodate the increase. The Snoqualmie plant when this increase is made will have a capacity of 25,000 horse power, and will therefore, it would seem, be the largest water power plant in the United States outside of Niagara. All the electric street cars, all the municipal and domestic lighting, [illegible] industries where eletric motors are employed in Seattle and Tacoma, are run by the Snoqualmie plant.

ELECTRIC RAILWAY DEPARTMENT.

THE LATE JOHN ROSS KERR.

The late John Ross Kerr, whose death took place in Montreal early in August, was born at Kingston, N.Y., on November 20th, 1872. He was employed for about three years at the C.P.R. shops, Montreal, and for a time in the works of the Dominion Bridge Company. Removing to Toronto, he was engaged for nearly three years with the Toronto Street Railway Company, in the shops and as inspector of motors. In 1893 he entered the works of the Canadian General Electric Company at Peterboro, Ont., remaining there for two years, when he was chosen from among



THE LATE JOHN ROSS KERR.

the many students there to manage the Galt, Preston & Hespeler Street Railway, which position he held for four years.

Mr. Kerr's health becoming impaired, he decided to go to Jamaica, and accepted the position of manager of the West India Elecric Company, of Kingston. His management of this road was eminently successful. In June last he returned to Canada on a business and pleasure trip, but was taken ill while in Montreal and died on August 4th. He was buried in the family lot at Kingston, N. Y., on August 6th.

BRITISH COLUMBIA ELECTRIC RAILWAY COMPANY.

The fifth ordinary general meeting was held at Cannon Street Hotel last month. Mr. J. Horne-Payne, K. C., presiding (in the absence of Mr. R. M. Horne-Payne, the chairman, in British Columbia). In moving the adoption of the report, he said that the board congratulated the shareholders on the great prosperity of the company. He compared the condition of affairs to-day with their position 2½ years ago, showing the great advance that had been made. The gross earnings for the past year were £102,435, or £27,235 more than in 1898, an increase of 36.19 per cent. The net earnings showed results not less favorable. In 1898, when they invited shareholders to bring in new capital, they were £27,870; for the year that had just expired the net earnings were £41,092, or an increase of £13,212, or 47.4 per cent. That progress had involved an inevitable increase of capital. In a business such as theirs, with a prosperous and constantly growing lighting and traffic, they had to be continually finding new capital. The capital expenditure was shown in detail in the report, and included £52,415 for lighting extensions. The larger that item was the better they were pleased. Every success in lighting meant an increase in net revenue. There was an outlay of about 17s. per lamp upon which they were continually earning a return. There was also the item of the new power house for supplying energy to meet the new demands, and the new machinery, boilers, and rolling stock, the last mentioned to cope with the growing traffic. The board had to be very careful with reference to the growing demands for fresh capital expenditure however unavoidable, and they might find it advisable in future to recommend ordinary shareholders to reserve their large cash earnings to meet that expenditure.

The report was adopted, and resolutions declaring dividends, re-electing directors and auditors, and thanking the directors, were also passed.

A ROYAL TROLLEY CAR.

A magnificent royal car—probably the first in the world built for royalty—is now under construction by the Ottawa Electric Railway Company. The company is not sparing expense to make it one of the best electric cars that has ever run on any track. It is to be finished in a most elaborate manner, and on the front will be painted the name of the car, "The Duchess of Cornwall," and on the other side will be carved the royal coat of arms. The car is to be finished in the royal colors, and on the inside, besides the fancy brass work and plate mirrors, will be a number of wicker and upholstered chairs. The car will carry the royal party to Britannia, where the Ottawa lumbermen will have a timber crib, which will be boarded for a trip through the Deschenes rapids and down the timber slides at Chaudiere Falls. The design of the car has been approved by Lord Minto and Sir Wilfred Laurier.

AMERICAN STREET RAILWAY ASSOCIATION

THE twentieth annual meeting of the American Street Railway Association is to be held at Madison Square Garden, New York city, October 9th to 11th. A large number of very interesting papers will be read and discussed, and the attendance promises to be the largest in the history of the association.

The Canadian Pacific Railway has, for some time past, been considering the practicability of utilizing the great stores of energy contained in the vast water power of the Rocky Mountains by converting this power into electrical energy and utilizing it to haul trains up the steepest grades. At the present time a number of assistant engines have to be kept at these points to help the trains over. It is probable that before long some definite plans in this connection will be laid before the directors.

The Van Buren Lumber Company has been organized at Bangor, Maine, to operate saw mills at Van Buren, Maine, and at Edmunston and St. Anne, N.B. It is the intention of the company to install electric plants at Van Buren and Edmundston for the lighting of their mills and the streets of the villages. Mr. John M. Stevens, of Edmundston, and E. A. Hammond, of Van Buren, are directors of the company.

NEW APPARATUS FOR THE OTTAWA ELECTRIC COMPANY.

The Ottawa Electric Company has recently contracted with the Westinghouse Electric & Manufacturing Company for a new equipment, including three 700-kw generators, to be equipped for waterwheel connection, and two 700-kw belted generators. In addition there will be supplied three 250 h. p. induction motors, one 300-kw rotary, with two 165-kw transformers, one motor-generator outfit of 22½ kilowatts capacity, one 37½-kw slow-speed multipolar generator and a special 56½-kw multipolar type generator.

Each of the 700-kw turbine-driven generators is a two-phase machine, and is to be of the two-bearing type, with a coupling on the shaft for direct connection to the end of a waterwheel shaft, revolving at a speed of 180 r. p. m. At 60 cycles each machine will have an output of 159 amperes per terminal at 2200 volts under a non-inductive load. The external frame will be divided in a vertical plane and movable from the shaft to permit easy access to windings. In all, there will be 40 poles upon this frame. The winding of the field coils is to be of strap on edge. The armature of the slotted drum type will be built up of laminated steel of the highest magnetic quality. Its wire-wound coils will be continuous and retained in position by fiber wedges. The two-phase current will be collected by special brass rings of the open ventilated type employed by the Westinghouse Company. The temperature conditions and regulation will be excellent.

The requirements of the Ottawa Electric Company were that the generator should under a non-inductive load have an efficiency of not less than 83 per cent. at one-quarter load ; 90.5 per cent. at one-half load ; 93 per cent. at three-quarters load, and 94½ per cent. at full load.

The machine will operate for 24 hours at 2200 volts, and at 159 amperes per terminal, at from 90 per cent. to 100 per cent. power factor with a rise in temperature not to exceed 40 degs. C. ; at 25 per cent greater current with the same power factor for 24 hours the rise in temperature will not exceed 50 degree C. ; at 50 per cent. greater current the rise in temperature will not exceed 60 dgs. C.

The 700-kw belted generators are of the three-bearing type with rotating armature. Each will generate two-phase currents at 2200 volts, 159 amperes per terminal under a non-inductive load. The journals will be self-oiling and self-aligning, while the shaft will carry a pulley 58 inches in diameter and 72 inches in face. The frame of the horizontally divided type will contain 22 poles, and at a speed of 327 r. p. m. the frequency of the machine will be 60 cycles. The regulation will be very close. In the case of this machine the Ottawa Electric Company requires that, on a non-inductive load, the efficiency should be less than 84 per cent. at one-quarter load ; 90½ per cent. at half load ; 93 per cent. at three-quarters load, and at full load 94 per cent.

The field coils will be wound with strap on edge and are to be placed on pole pieces so designed as to reduce the armature reaction and the self-induction to a minimum. The armature coils are to be continuous, wound from strap copper and retained in place by wedges of hard fiber.

The 250-h.p. induction motors are to be two-phase, Type "C," Westinghouse constant-speed C motors, with self-oiling and self-aligning bearings. They are intended to operate directly on the 2200-volt circuit at a speed of 580 r. p. m. under full load. Each is a 12-pole motor weighing approximately 11,000 lbs. The parts are a cylindrical yoke carrying the primary windings, and to which will be bolted circular end brackets to carry the bearings, and a rotating squirrel-cage secondary. The motor will have an efficiency of not less than 90 per cent. under its full load of 250 horse-power, and a power factor of not less than 91.5 per cent. The temperature conditions are a normal load for 24 hours, with a rise not to exceed 40 degs. C. ; a 25 per cent. overload for 24 hours with a rise not to exceed 50 degs. C., and a 50 per cent. overload for one hour with a temperature rise not to exceed 60 degs. C. It is intended to place a 125-light Brush arc machine on each end of each motor and to make direct connections by suitably flanged couplings.

The 56½-k. w. generator is of the special multipolar type, compound wound for 125 volts, and is intended to operate at 475 r. p. m. Its shaft is to be extended that the coupling may be placed outside of its pulley, and each machine is to be equipped with belt-tightener, base plate, flange coupling and pulley. Each of the 37½-k. w. direct-current generators is to be of the slow-speed multipolar type, compound-wound at 125 volts. The motor-generator outfit is to consist of one 22½-k. w. direct-current generator compound-wound for 250 volts, and one 30-h. p. slow-speed direct-current motor shunt-wound for 500 volts.

CANADIAN CABLES.

The Department of Public Works at Ottawa has been advised that the Government steamer "Tyrian," now at Gaspe, Que., has completed repairs to the cable between St. Paul's Island and Meat Cove, Cape Breton, which has been interrupted for some time past. The "Tyrian" has now left Gaspe for the purpose of laying the cable across the Strait of Belle Isle, which is to connect the Belle Isle station with the Government telegraph station on the mainland of Labrador. By the end of August, the coast signal service will be in permanent operation to Belle Isle, which is a most important point on the summer route between European ports and the St. Lawrence. Steamships will, hereafter, be reported by telegraph 760 miles below the port of Quebec. This will mean that a 20-knot vessel, taking the summer course, can communicate her arrival on this side of the Atlantic in less than four days out from Liverpool, England.

RED INDIAN TELEPHONISTS.

What is probably the only telephone system operated entirely by Indians is being installed in the village of Kish-Pie-Axe in Northern British Columbia. The system is to be connected by a 20-mile telephone wire from the telegraph office at Hazelton, half way between Ashcroft and Atlin.

That the tendency towards amalgamation now-a-days has been extended to journalistic circles as well as commercial,is shown by the recent purchase of The Canadian Home Journal by Mr. Hugh C. McLean, publisher of The Ladies Magazine, Toronto. The Journal, which was established many years ago, will be discontinued as a distinct publication, and will be merged into The Ladies' Magazine, which has already won a place for itself as the popular home paper for Canadian women.

ENGINEERING and MECHANICS

CANADIAN ASSOCIATION OF STATIONARY ENGINEERS.

TWELFTH ANNUAL CONVENTION.

THE Canadian Association of Stationary Engineers opened its twelfth annual convention in the City Hall, Brantford, on Tuesday, August 22nd, and it was one of the most successful in the history of the Association.

The following executive officers and delegates were in attendance: G. C. Mooring, Toronto, president; Charles Moseley, Toronto, vice-president; A. M. Wickens, Toronto, secretary; William Oelschlager, Berlin, treasurer; George Dawson, Hamilton, conductor; John M. Dixon, Toronto, door-keeper. R. Pettigrew, G. W. Dawson, Joseph Ironside, T. Chubb, Hamilton; W. J. Webb, J. Huggett, A. E. Edkins, E. J. Philip, W. Outhwaite, N. V. Kuhlman, J. M. Dixon, Toronto; J. R. Uttley, Waterloo; J. Heyd, Berlin; R. Turkington, Brockville; J. Struthers, Sarnia; James Ogle, Brantford.

The visitors during the convention included William Bourne, Thomas Pilgrim, A. McKinnon, Morgan Harris, Charles Waterous, David Waterous, Lloyd Harris, Joseph Butler, Charles Walker, Fred Temperance, L. Fordham, R. Lee, W. F. Gunson, Charles Doherty, Geo. Scace, J. Barker, E. Jones, J. M. Jones, D. Potter, S. Mills, W. H. Mitchell, J. Miller, W. Muir, W. H. Sweet, W. Brazin, D. Telfer, A. Sage, J. E. Taylor, J. Henderson, W. Schultz and J. Searle.



EXECUTIVE OFFICERS AND DELEGATES C. A. S. E. CONVENTION, BRANTFORD, AUGUST, 1901.

1. J. R. Uttley.
2. Joseph Ogle.
3. J. Pierce.
4. W. J. Webb.
5. George Dawson.
6. R. C. Pettigrew.
7. J. Ironsides.
8. R. W. Turkington.
9. A. W. Smith.
10. J. F. Birchard.
11. E. J. Philip.
12. N. B. Kuhlman.
13. S. McKinnon.
14. W. Bourne.
15. James Dixon.
16. Charles Moseley.
17. G. C. Mooring.
18. A. M. Wickens.
19. A. E. Edkins.
20. T. Chubb.
21. W. Outhwaite.
22. J. Struthers.
23. P. Trowern.
24. S. Pilgrim.
25. James Huggett.

The opening business of the convention was the appointment of the following committees:

Committee on Credentials.—W. J. Webb, J. Ironsides, W. Oelschlager, J. R. Uttley, R. W. Turkington.

Committee on Constitution and By-Laws.—A. M. Wickens, J. M. Dixon, T. Chubb, J. Ogle, W. Struthers.

Committee on Good of the Order.—James Huggett, C. Moseley, Jacob Heyd, J. M. Dixon, A. E. Edkins.

Auditing Committee.—N. V. Kuhlman, W. Dawson, Peter Trowern.

Mayor H. N. Wood welcomed the Association to Brantford on behalf of the council and citizens, and hoped their visit would be a pleasant one. Aldermen Wade and Halloran also gave a few words of welcome.

Adjournment was then made until 2.30 p. m., when business was resumed. The president read his opening address, as follows:

PRESIDENT'S ADDRESS.

Brethern, I am proud of the honor of welcoming the officers, delegates and friends to this, the twelfth annual convention of the Executive Council of the Canadian Association of Stationary Engineers. We certainly made no mistake last year when we accepted Bro. Ames' invitation to hold our next convention in Brantford. I wish to thank you for placing me at the head of this organization a year ago—the highest office in your gift, an honor which I have always craved. I hope you will overlook my short-comings, for they are many. It gives me the greatest pleasure to greet old friends and welcome new ones, to help along the work of this, the best engineering society in the world. Our old friends must have performed this work well at other conventions or they would not have been sent back again as representatives. I hope to see the younger members as well as the older ones take an active part in all our deliberations. I ask that you support the occupant of the chair as on all former occasions.

For my part I will endeavor to give equity and justice to all. I understand tnere are many matters of grave importance to to come before this meeting for your most earnest consideration, such as: Shall we meet annually or bi-annually? What can be done to increase our membership? Shall we keep on trying to secure an inspection and license law from the Ontario government? In this last matter we have certainly advanced one step since last we met, in securing the inspection of boilers by the factory inspectors. I would say, keep on pegging away until we get such a law or turn the party out. Our progress has not been as rapid as I would have liked, still we are advancing slowly but surely. We have started one new Association in Sarnia since our last convention. We have been trying to wake up some of the dormant ones. We have increased our membership and our finances are in a healthy condition, as will be shown by the treasurer's report. The secretary, past-president Wickens, who has had most of the hard work to do, will enlighten us on the work of the year. I hope his report will be full and comprehensive. I have no doubt the subordinate associations have been careful in the selection of their new members. But, brethern, we must admit that there are many good engineers outside of our order. I do hope that the Ways and Means Committee will devise some plan to interest these men, and show them that it is to their advantage as well as ours to throw in their lot with us, that we are working for them as well as ourselves, our employers and the public at large.

Quite a number of our associations have done good work along the educational line by having open meetings, lectures, short talks, etc. I am sure the thanks of this order is due to those members on the different educational committees. Their work is of permanent benefit to this society. In closing, I wish to thank the officers and members for their kind and liberal support

during the year. Let us always remember our motto, "Safety, Economy, Reliability, Intelligence."

G. C. MOORING,
President Executive Council.

The address was received with applause and referred to the Committee on Good of the Order.

The Secretary then read his annnal report, which was as follows :

SECRETARY'S REPORT.

"Our membership report last year gave us 162 members to start the year with, divided up into 9 associations. We have been able to start one new branch—Sarnia, No. 20—and can report it as a vigorous and earnest association. We are pleased to say that our membership has increased, and is now 288 members, comprised in 10 associations. We have also many encouraging letters from ex-members in towns where the work has lapsed, and hope to be able to report several of them again in active work. We fully expect that London, Kingston and Ottawa will again be in line. The recommendation of the Committee on the Good of the Order, to have the different associations visit neighboring towns for missionary work and to promote organization, has not been acted upon by any of the lodges, and any work of that kind has fallen upon the secretary. We would strongly recommend that a small committee be struck for that purpose and that a small sum of money be placed at their disposal. Your legislative committee again put forth their best endeavors for a license law. We had joint meetings with the O. A. S. E., and interviews with several crown ministers, and entered a bill which passed two readings, and by advice from the Hon. H. H. Carscallen, who presented the bill, it was withdrawn, as the government had promised a bill for boiler inspection. The government then amended the Factories' Act so that boilers coming under the Act must be inspected, and such law is now in force. As to the working of it, however, we can say nothing. The trouble seems to be that there are no inspectors. The manufacturers' request that any engineer of five years' experience be allowed to inspect is wrong, as no man should inspect the plant he operates. Your committee appointted to see the Locomotive Engineers re legislation, visited them at their meeting and explained to them our position. After some discussion we left, feeling that we had removed their opposition. The matter of issuing papers for this year has not been carried out fully. We had some delay and also considerable difficulty in getting together a proper mailing list. The delay carried us into the legislative season, during which all our time was fully occupied. I am still strongly recommending that these papers be resumed, but would ask for a small committee to help, as it is rather too much work and responsibility for the secretary alone to assume. Our hand-book business is still unsettled. I have since last convention received settlement for 80 books, and also have acknowledgment for 16, which will soon be converted into cash. I have in hand 5 books. There are still some 90 books that no settlement can be had for, because it is impossible to find the persons they are charged to. The receipts and expenditures have been as follows :

RECEIPTS.		EXPENDITURE.	
Capitation dues	$141 00	Paid Treasurer	$348 15
Treasurer	266 22	Convention expenses	44 35
Stationery	27 43	Printing	51 50
Charter	15 00	Postage	13 15
		Charter	12 50
	$469 65		$469 65

A. M. WICKENS, Secretary.

The treasurer's report was submitted by W. Oelschlager and referred to the auditing committee.

The Secretary was instructed to forward letters of condolence to Past-Presidents W. F. Chapman, of Brockville, and Thos. Ryan, of Montreal, both of whom have recently lost their wives, and a letter of sympathy to President T. Graham, of Toronto No. 18, who is indisposed.

The meeting then adjourned to visit the works of the Waterous Engine Company and accept their kind invitation for a drive around the city. The visit to the works proved most interesting and instructive. The first places visited were the draughting-room, pattern shop and blacksmith's shop. The latter building is 60 x 120 feet, and contains 16 large forges and a pneumatic rivetter with a capacity of 75 tons pressure on rivet. The next part visited was the boiler room. The dimensions of this room are 220 x 80 feet. Here we found two large boilers 6 feet in diameter, 16 feet long, and 125 pounds pressure. Next a visit was made to the moulding shop, 180 x 80 feet. Here a large number of men are constantly employed moulding patterns. They also have a pattern vault of three stories, each 80 x 60 feet. The next place visited was the fire-engine department, where was seen in process of construction a large engine for Magog, Que., which has since been exhibited at the Toronto Industrial Exhibition.

The drive was resumed around the city to the pumping house, where D. Webster is in charge. The visitors then repaired to the Cricket and Lawn Tennis Club House, where an appetizing lunch was served by Messrs. C. H. and David Waterous.

EVENING SESSION.

The evening session, which was an open one, was well attended. A paper on "Wasted Heat" was read by Mr. Wickens, and one on "The Relation of Employer and Employee," by J. M. Dixon.

An invitation from Mr. Lloyd Harris, vice-president of Brantford Board of Trade, for a drive on the following day to visit the Bow Park Farm, was accepted.

SECOND DAY.

At 9 o'clock a.m. the President called the convention to order.

The reports of the Committees on Mileage, Auditing, and Finance were presented and adopted.

On motion by Messrs. Edkins and Lawlor it was decided to take up the report of Committee on Constitution and By-laws clause by clause.

Section 1 of Article III was amended so as to reduce the term of practical experience necessary for membership from 3 years to 2 years. The candidate must be a resident of Canada for at least one year, and of the jurisdiction of the lodge for at least 3 months.

Section 4 of the same article was amended to read as follows : "All subordinate associations shall pay with each semi-annual report in advance a per capita tax of 25 cents for each member on their books in good standing."

Section 13 of Article IV was amended to relieve the trustees of the duty of auditing accounts.

A fourth section was added to Article VI. as follows : "If a candidate does not present himself for initiation within four months after being balloted for, he shall forfeit his fee and have to make a new application, unless by a two-thirds vote the lodge decides otherwise."

A new Section was added to Art. VIII, which now reads as follows : "Section 1. The application fee shall be $1, and shall be paid by all candidates." "Section 2. The initiation fee shall not be less than $2, and shall be paid by all candidates."

The report of the Committee on the Good of the Order, as finally adopted, is as follows :

1. That at the next session of the Legislature this Association shall petition that body to pass a law regarding Engineers and Boiler Explosions and Accidents, similar to the law now in force and working so satisfactorily in Great Britain.

2. That a committee be appointed to issue 8 Educational Papers to the local Associations (and steam users if it be deemed advisable) in each year—as we regard such issues as a link between the Executive and the local Associations.

3. That Executive Officers should visit each local Association at least twice a year, and in our opinion this duty should be performed by the Executive President, or failing this, by some other member under his instructions.

4. That the Executive Officers should meet twice a year and be prepared to advise the local branches as to their government, etc.

5. That we would impress upon the Convention assembled the necessity of the delegates impressing upon the membership of their respective Associations the importance of the educational feature in their meetings, as being the means of stimulating the growth and general advancement of the Association as a body.

6. That in our opinion the financial books and accounts of this Association should be audited before this Convention assembles, in order that the work may be properly done and expedite the business of Convention.

7. That the Executive Secretary be imperatively instructed to call in all charters that are lapsed, forthwith.

8. The matter of ways and means has been referred to us, but in our opinion the scope of this matter is too wide for us to deal with, when time is so limited, therefore we beg respectfully to leave said matter with the Convention as a body.

Adjournment was announced, and a visit paid to the Bow Park Fram, Brantford Pork-Packing Company's factory, and the plant of the Brantford Electric & Operating Company. The President and John M. Dixon thanked Mr. Harris for his kindness, to which he replied in a very neat speech.

AFTERNOON SESSION.

The President in the chair, called the Convention to order at 2.30 p.m. R. C. Pertigrew recommended the purchase of the chart of the metric system, and it was decided that one be purchased for each Association. Discussion on the subject of "Printed By-Laws" came up. On motion of R. C. Pettigrew, seconded by N. V. Kuhlman, permission was granted to have the by-laws printed by each local Association, if desired. R. C. Pettigrew spoke of the lack of publicity the Association was receiving from the press. Messrs. Edkins and Phillips made the statement that is was entirely the fault of the Secretary of the different branches in not advising the press of the proceedings of their respective branches. The representatives of the Canadian Engineer and CANADIAN ELECTRICAL NEWS assured the Convention that notices of meetings and other information would always be willingly published.

The election of officers was then proceeded with, and resulted as follows:—President, Charles Moseley, Toronto; vice-president, W. Oelschlager, Berlin; treasurer, G. W. Dawson, Hamilton; secretary, A. M. Wickens, Toronto; conductor, John M. Dixon, Toronto; doorkeeper, J. Struthers, Sarnia.

Educational Committee—A. M. Wickens, J. M. Dixon, W. J. Webb, J. Huggett, E. J. Phillip.

Legislation Committee—E. J. Phillip, A. E. Edkins, W. Outhwaite, N. V. Kuhlman, A. M. Wickens, J. Huggett, George Mooring.

The retiring president, G. C. Mooring, was presented with a past master's jewel. The next order of business was the selection of a place for the next annual convention. After a spirited voting contest Toronto was chosen. The usual grant was made to the Secretary, and votes of thanks were tendered to the Mayor and aldermen, the scrutineers, the press, and to those who had assisted to entertain the delegates.

THE BANQUET.

The annual banquet was held at the American Hotel on the evening of the 23rd ultimo, Mr. Charles Moseley, Toronto No. 1, officiating as chairman. After the sumptuous repast was disposed of the toast list received attention. Responses were made as follows: "The King." "Ontario the Banner Province," T. H. Preston, M.P.P.; "Brantford, the Telephone City," Mayor D. B. Wood; "The Manufacturers," C. H. Waterous; "The Executive Council," A. M. Wickens, E. J. Phillip, John M. Dixon; "The Press;" J. F. Birchard, CANADIAN ELECTRICAL NEWS, and A. W. Smith, Canadian Engineer. The evening was one of wit, humor and jollity, and the respondents to the different toasts, who handled their subjects very capably, were heartily applauded at the conclusion of their remarks. During the evening a musicl programme was rendered, in which J. M. Dixon, of Toronto, and Sam. Burnley, of Brantford, assisted materially. The local committee, Messrs. Pilgrim, Ogle and McKinnon, were heartily thanked for their untiring efforts to entertain the delegates.

HAMILTON NO. 2.

At the last regular meeting of Hamilton No. 2, a vote of thanks was tendered to the members of the Brantford Association for the manner in which the delegates were entertained at the recent convention in that city. A motion was adopted that the open educational meetings for the coming season be commenced on October 10th. A committee was appointed, and some very interesting papers are likely to be given. The Association is endeavoring to help not only members of the Association but all persons interested in engineering work.

The scheme to transmit electric power from Keewatin, Ont., to Winnipeg Man., has again been revived. The Keewatin Power Company about four years ago completed at large expense the construction of an immense dam across the Winnipeg river just at the point where it issues from the Lake of the Woods. It is constructed of granite stone and English Portland cement. The power thus developed is 30,000 horse power, which has not been utiltzed. The improvements in long distance transmission have been such that the company are said to have decided to install the necessary plant at once for the utilization of the power, and are now negotiating with electrical manufacturing companies with a view to placing the contract. The intention is to transmit the power to the city of Winnipeg.

WASTED HEAT.

BY A. M. WICKENS.

THIS subject is so far reaching that we cannot fully go over it in a paper as short as this must necessarily be, so we will content ourselves by looking at some of the points connected with it. As heat is the source of life, and also of all motion, its influence penetrates everything in the whole universe. The great heat given to the countless worlds that travel in their orbits, in a boundless and immeasurable space, is from the sun. Sir William Herschel tells us that if a cube of ice 45 miles in diameter and 200,000 miles long were placed endwise into the sun, it would be melted in one second of time. What the effect of this vast heat is on other worlds we cannot tell; what the conditions of life, what manner of souls, what kind of an atmosphere, nor in fact any of the particulars, we know not. Had we a full knowledge of all things we undoubtedly would be able to utilize the great sun heat, to create our motive power direct from its rays, and while our knowledge of other worlds is extremely limited, we have been able to learn something concerning our own surroundings, and the wonderful combinations of nature, provided by an all-wise Providence for the use and benefit of the inhabitants of this earth. If we could imagine anything perfectly cold, it would be without motion, perfectly still, and absolutely dead. The earth, the rocks, the trees, the air, are all moved continuously, and are subject to constant vibration, the direct cause of which is the heat and light of the sun. The human eye and ear, two of the most wonderful parts of our organism, would be useless to us as they are now constructed, were it not for the vibrations of the light and heat of the sun coming to us through the atmosphere surrounding the globe. It is by utilizing these vibrations that we have telephones, telegraphs, electric lights, music and many of our conveniences and pleasures of life. As we become more enlightened on this line, it will be safe to say that much of the complication of construction, cost of operating and maintainance in all these different branches will be reduced, and we as engineers should also expect as we gain knowledge to be able to show better results in the evaporation of water for power purposes.

The efforts of the eminent engineers of the world during the last fifty years have been in a great measure directed toward the improvement of the steam engine; their strides have been rapid, their achievements great and their success almost phenomenal, resulting in a reduction of water consumed per horse power hour, from over 60 lbs. to 12½ lbs. The improvements in the evaporative efficiency of our boilers have not kept pace with the engine improvements, and it seems to me that we must look for greater evaporative efficiency in our boilers to further reduce the cost of steam as a prime mover. The man who daily utilizes the heat should, if he will study it up, be able to convert into mechanical work a greater portion of the heat of the fuel than is now generally utilized. It is evident in order to do this he must first acquaint himself with the component parts of the fuel, and the chemical combinations that occur during its combustion.

The advancement of all science during the last century has been marked by greater discoveries than all the preceding centuries before it; galvanism, magnetism, electricity and chemistry have been developed until they are factors for our daily use. The greatest discovery in chemistry was oxygen, made by D. Priestley, in 1774. Its discovery was really an accident, but was soon turned to account by the learned doctor. In the study of chemistry several things should be kept in mind: 1st. Where is the element under study to be found? 2nd. How can it be obtained in a separate state? 3rd. What are its properties? 4th. What other elements will it combine with, and what will be the resulting compounds?

Oxygen is the most widely connected with the other elements of all our gases. It composes about 1-5 of

*Paper read at annual convention Canadian Association Stationary Engineers, Brantford, August [illegible].

the atmosphere, and fully 8-9 of all our waters. Its most remarkable propensity is its energy in supporting combustion, anything that will burn in atmospheric air will burn in pure oxygen with the splendor of a meteor. Nitrogen, another of our gaseous elements, is part of our atmosphere, and composes about 4-5 of the atmosphere. It combines with the oxygen, but not chemically, (as we will see later on). It will not support either life or fire, and in its combination with oxygen it seems to dilute it in order that we may not live too fast, that our fires, lamps or any other material may not burn too fast, and also that our iron utensils may not rust too fast. The atmosphere being composed of oxygen and nitrogen, we have these two elements to combine with our coals in order to get heat. Taking the average quality of American coal we find it composed of carbon, oxygen, hydrogen, ash and sulphur ; we have then air composed of oxygen and nitrogen to mix with our coal. The air contains oxygen, 21 parts ; nitrogen, 79 parts ; and the coal has carbon, 80 parts ; oxygen, 5 parts ; hydrogen, 7 parts ; ash, 8 parts. Now what occurs when these elements are combined? The oxygen and carbon unite and form a new gas called carbon dioxide or carbonic acid gas. The oxygen and carbon combine, but the nitrogen in the air remains neutral and is still nitrogen ; this shows that its mixture with oxygen is only mechanical and not chemical. To support perfect combustion we must supply 1 lb. of carbon with 2.66 lbs. of oxygen, carrying with it 8.94 lbs. of nitrogen ; the product is 3.66 lbs. of carbonic acid gas ; the nitrogen, 8.94 lbs., passing off in an unaltered state, excepting that it has been heated by our fire, and is expanded into about double its volume. The total weight of the product of combustion is 12.6 lbs., but we have left out the hydrogen in the coal, also the sulphur ; we will require for the perfect combustion of 1 lb. of carbon, 1 lb. of hydrogen and 1 lb. of sulphur, the following quantities of atmospheric air : For the hydrogen, 34.8 lbs., or 457 cubic feet ; this product is water; for the carbon, 11.16 lbs., or 152 cnbic feet, and the product is carbonic acid. The sulphur will use 4.35 lbs., or 57 cubic feet, product, sulphurous acid.

The heat units contained in one pound of carbon, perfectly burned, is 14,800 ; should the air be reduced to ½ in quantity, 5.7 lbs., or 76 cubic feet, the product would be carbonic oxide, sometimes called marsh grass. The heat units per lb. of carbon burned to marsh grass are only 4,800, thus wasting 10,000 heat units for each lb. of carbon thus burned. It is evident that the chief factor in the economical use of coal is to supply the correct quantity of air, and in order to do so, we must so construct our furnaces, grates and openings to carry the right amount of air. In tests conducted at the Centennial Fair in 1876, it was found that passing 24% more air through the fire than was theoretically required, had no effect upon the evaporative efficiency of the boiler. In a test of fifteen boilers there, it was found that by reducing the rate of combustion 30%, the quantity of water evaporated was only reduced 23%, and at the same time the efficiency was increased 8½%. This goes to prove there is no economy in forcing a boiler.

In Germany a test of nearly four years duration on two tubular boilers, steaming night and day, showed that 60% of the heat was utilized, and that more than half of the remaining 40% was lost through the brick walls. The average heat of the escaping gases was 360 degrees F. and carried off 5½%, while losses due to ungenerated heat and unburned carbon was about one-half of 1%. The proportion of grate surface to heating surface was changed three times. The most economical point being 10 foot grate to 340 feet heating surface. Sometimes the distance of grates from the boiler is a factor—do not get them too close. The proportions of tube heating surface to the shell surface should also be proportional about 5 to 1. The chief consideration for economical combustion is the correct air supply. It is not possible to attain perfect combustion with the theoetical amount of air, which is 11.16, or 152 cubic feet, per lb. of coal, because in the conditions obtained in our furnaces we cannot get the air into perfect contact with the burning carbon of the coal. For this reason we have to supply about double the quantity of air, or 24 lbs. If more air than is actually needed is allowed into the furnace it simply carries heat from the furnace to the chimney, while if too little is used we get marsh gas instead of carbon dioxide. If it were possible to heat the air during the short time it is going through the fuel up to the heat of the fuel, the theoretical amount would be all we would require for perfect combustion ; one of our losses in the furnace is the driving off by the heat of the hydro-carbons contained in all our bituminous coals, before these coals really begin to burn. These gases are driven off, and are very likely to escape unburned up the chimney. The admission of a small quantity of air above the fire will sometimes burn them. If they are not burned they escape as black smoke. The best smoke burner in the world is a fireman that knows how to handle his fires in well set boilers with ample draft.

PERSONAL.

The sympathy of many friends is being extended to Mr. W. F. Chapman, engineer at the water-works, Brockville, Ont., owing to the recent death of his wife.

Mr. Edward Smith, manager at St. Stephen, N. B., of the local telephone company, has accepted a responsible position with an electrical company at Bellows Falls, Vermont.

Mr. George E. Waller, who has been chief clerk of the Hamilton, Grimsby & Beamsville electric railway, has been promoted to the managership of that road, as successor to Mr. A. J. Nelles, who tendered his resignation. Mr. Nelles had been manager for about six years.

The many friends of Mr. E. E. Cary will be pleased to learn that he has been appointed Export Manager for the Adams-Bagnall Electric Co., of Cleveland, Ohio, with offices in the New York Life Building, Montreal.

Mr. W. H. Lewis, who for several years has represented the Atlantic Refining Company, of Toronto, in Western Ontario, has been appointed manager of the Vancouver branch of that business. Before leaving Toronto an elegant music cabinet was presented to Mr. and Mrs. Lewis by their many friends.

The Quebec Railway Light & Power Company have appointed Mr. J. A. Everell superintendent of the Montmorency and St. Anne [illegible] H. N. Bartlett assistant superintendent of the Citadel division. Mr. W. R. Russell, general superintendent, has resigned.

Mr. William S. Aldrich, who has recently been engaged in consulting engineering practice in Toronto in association with Mr. Cecil B. Smith, has been appointed to the directorship of the Thomas S. Clarkson Memorial School of Technology at Potsdam, N. Y., and the partnership has consequently been dissolved. The entrance requirements of this school are those of the Regents of the University of New York. There are regular four year engineering courses in theoretical and practical work leading to degrees of Bachelor of Science in civil, electrical and mechanical engineering.

TRADE NOTES.

An attractive catalogue of the Mumford steam boiler has been issued by the Robb Engineering Company, of Amherst, N.S. The design and construction of the boiler is fully illustrated and explained, and in addition there are several tables which will be found very useful to engineers. Persons interested may obtain a copy of the catalogue for the asking.

Every steam user and engineer should secure a copy of the catalogue just issued by the Jenckes Machine Company, of Sherbrooke, Que., descriptive of their horizontal tubular boilers. The work is replete with valuable tables of trimmings, fixtures, standard stacks, boiler setting, etc., and also contains plans for setting horizontal tubular boilers, and much other information regarding safety valves, injectors, etc. There is a carefully prepared index which permits of finding the information desired very readily.

APPLICATION OF WIRELESS TELEGRAPHY.

On Friday, August 16, the wireless telegraph system for announcing the arrival in American waters of transatlantic vessels provided with proper sending apparatus was successfully inaugurated. The Nantucket Shoals lightship, anchored some 35 miles to the southeast of the island of Nantucket, has been equipped with Marconi apparatus, and a station has also been erected at Siasconset, on Nantucket. The latter is connected by telephone and telegraph with the mainland. On the evening in question, the steamship Lucania, being then off the lightship, reported her arrival and exchanged several messages with the shore. This is one of the most interesting and really important applications that wireless telegraphy has received, as it enables incoming steamships to be reported twelve to eighteen hours before they arrive at New York.

METERS FOR TELEPHONES.

Telephones with meters are being introduced by the Chicago Telephone Company. The meter attachment registers the number of outgoing calls. When a subscriber desires to use his telephone he asks Central for the number, and, when in communication, he pushes a black button immediately above the transmitter, which operates a counting machine. Until he pushes this button he cannot make himself heard at the other end.

OLD TIME TELEGRAPHERS' ASSOCIATION.

The ELECTRICAL NEWS is indebted to the president of the Old Time Telegraphers' Association, which will hold its annual convention in Montreal on September 11th to 13th, for an invitation to the annual banquet to be held at the Windsor Hotel in that city on the evening of the 12th inst.

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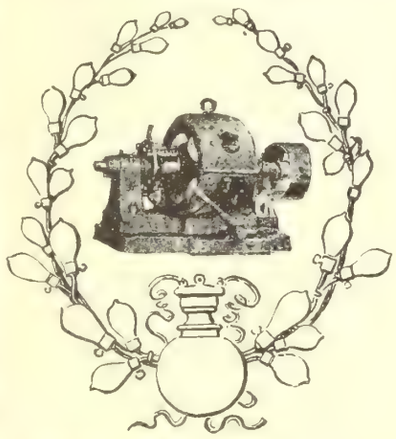
RECENT PLANTS INSTALLED: Lachine Rapids Hydraulic & Land Co., Montreal, Que., 12,000 h.p.; Chambly Manufacturing Co., Montreal, Que., 20,000 h.p.; West Kootenay Power & Light Co., Rossland, B.C., 3,000 h.p.; Dolgeville Electric Light & Power Co., Dolgeville, N.Y.; Honk Falls Power Co., Ellenville, N.Y.; Hudson River Power Transmission Co., Mechanicsville, N.Y.; Quebec Railway, Light & Power Co., Quebec, 4,000 h.p.; The Ottawa Electric Co., Ottawa, Ont., 2,000 h.p.

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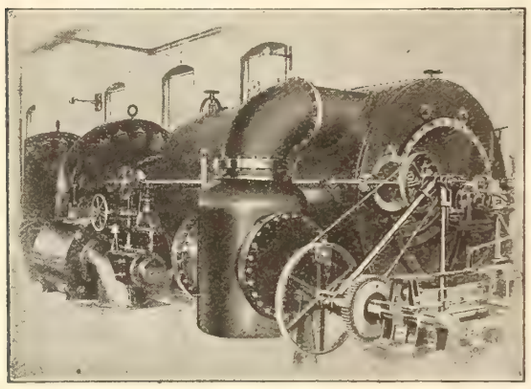
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McCORMICK TURBINES OPERATING ELECTRICAL MACHINERY IN THE CELEBRATED COMSTOCK MINES.

The illustratiou on this page represents a pair of 27 inch McCormick turbines mounted in an iron case on horizontal shaft direct connected to generator. They develop 1,400 horse power with 400 revolutions when operating under 84 feet head. The extra pressure upon the wheel case and supply pipes, caused by the heavy changes of load, is taken care of by a Ludlow relief valve working in connection with a Lombard water wheel governor. Two 15 inch McCormick turbines in iron cases on horizontal shafts are direct connected to the exciters. Two of these settings complete were built by the S. Morgan-Smith Company, of York, Pa., for the Truckee River General Electric Company,



PAIR MCCORMICK TURBINES.

Floriston, Cal. The power is transmitted 35 miles to the celebrated Comstock mines and is used for pumping water and operating mining machinery.

The S. Morgan-Smith Company also lately supplied the following: The Floriston Pulp & Paper Company, Floriston, Cal., with horizontal shaft McCormick turbines, operating under 50 feet head, developing 4,700 horse power, which are used for driving machinery in its pulp and paper mill; The Walla Walla Gas & Electric Company, a single 27 inch McCormick turbine which operates an electric plant under 90 feet head; The Boston & Montana Consolidated Copper & Silver Mining Company, Great Falls, Mont., a pair of horizontal shaft 54 inch McCormick turbines developing 2,800 horse power; The Washington Water Power Company, Spokane, two pairs McCormick turbines in iron cases on horizontal shafts, each pair developing 1,800 horse power under 68 feet head; Oregon City Manfg. Company, Oregon City, pair 36 inch in iron case on horizontal shaft; Willamette Pulp & Paper Company, Oregon City, Ore., a pair of 36 inch mounted in a similar manner; Crown Paper Company, Oregon City, six horizontal shaft McCormick turbines in iron cases; The Missouri River Power Company, Helena, Mont., seven sets of horizontal shaft McCormick turbines of 7,000 horse power capacity.

Those interested in the development of water power are requested to write the S. Morgan-Smith Company for catalogue of the McCormick turbine.

SPARKS.

A resident qualified engineer is wanted for McGill University, Montreal.

The Smith's Falls Electric Company have just installed a new 2,000 incandescent light machine and a 350 horse power water wheel.

A neat little booklet entitled "A Synopsis of the S.K.C. System" has been issued by the Canadian General Electric Company.

The Napanee Electric Light Company has absorbed the John R. Scott Company, which controlled the lighting along the Napanee river.

The Leader Automobile & Engine Company, of Toronto, has been incorporated, with a capital of $25,000. Messrs. S. E. Van Camp and W. J. Cummings are provisional directors.

A dispatch from Vancouver, B.C., dated September 5th, states that Mr. H. Payne, of the British Columbia Electric Railway Company, has announced that the company is about to install an electric plant at Coquitlam Lake, near Vancouver, capable of generating 5,000 horse power and of being increased to 15,000 horse power.

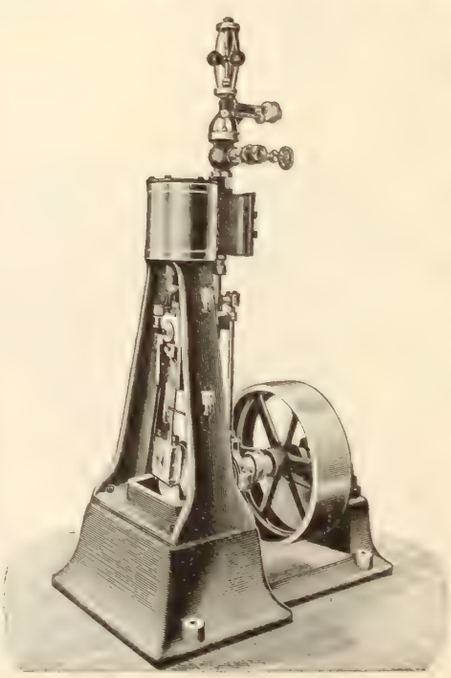
Messrs. Brewder & McNaughton, contractors for the power canal of the Metropolitan Electrical Company at Ottawa, have made an assignment. It is said to be the result of a suit brought by the contractors against the Metropolitan Electric Company for illegal detention of their plant and assets, on account of their failure to complete the contract within a certain time.

Mr. Thos. A. Edison, the famous electrician, recently made an inspection of the mines in the vicinity of Sudbury, Ont. The citizens of that town on August 18th presented him with an informal address welcoming him to the town and expressing the general appreciation of his visit to the district. It is surmised that Mr. Edison intends to acquire mineral lands, with a view possibly to securing nickel for some of his industries, or to make arrangements for the use of some of his processes for separating or reducing ores in some of the existing plants, or plants to be established.

INSULATING POWER OF ELECTRICIANS' GLOVES.

The Central Electric Laboratory, of Paris, has recently carried out a series of experiments bearing on the degree of insulation of electricians' gloves. The tests were made both with low pressure and high pressure. The practical conclusion arrived at is that insulating gloves can not be considered to afford efficient protection against the dangers surrounding high tension currents; it would even be preferable to proscribe their use altogether rather than rely upon their efficiency in the contact with dangerous connections. It is prudent only to consider them useful for working those parts already insulated from the lines, such, for instance, as non-metallic handles of switches. One glove, which withstood a potential difference of 12,200 volts, got pierced in one minute; another kind was pierced after three minutes with a potential difference of 1,000 volts only.

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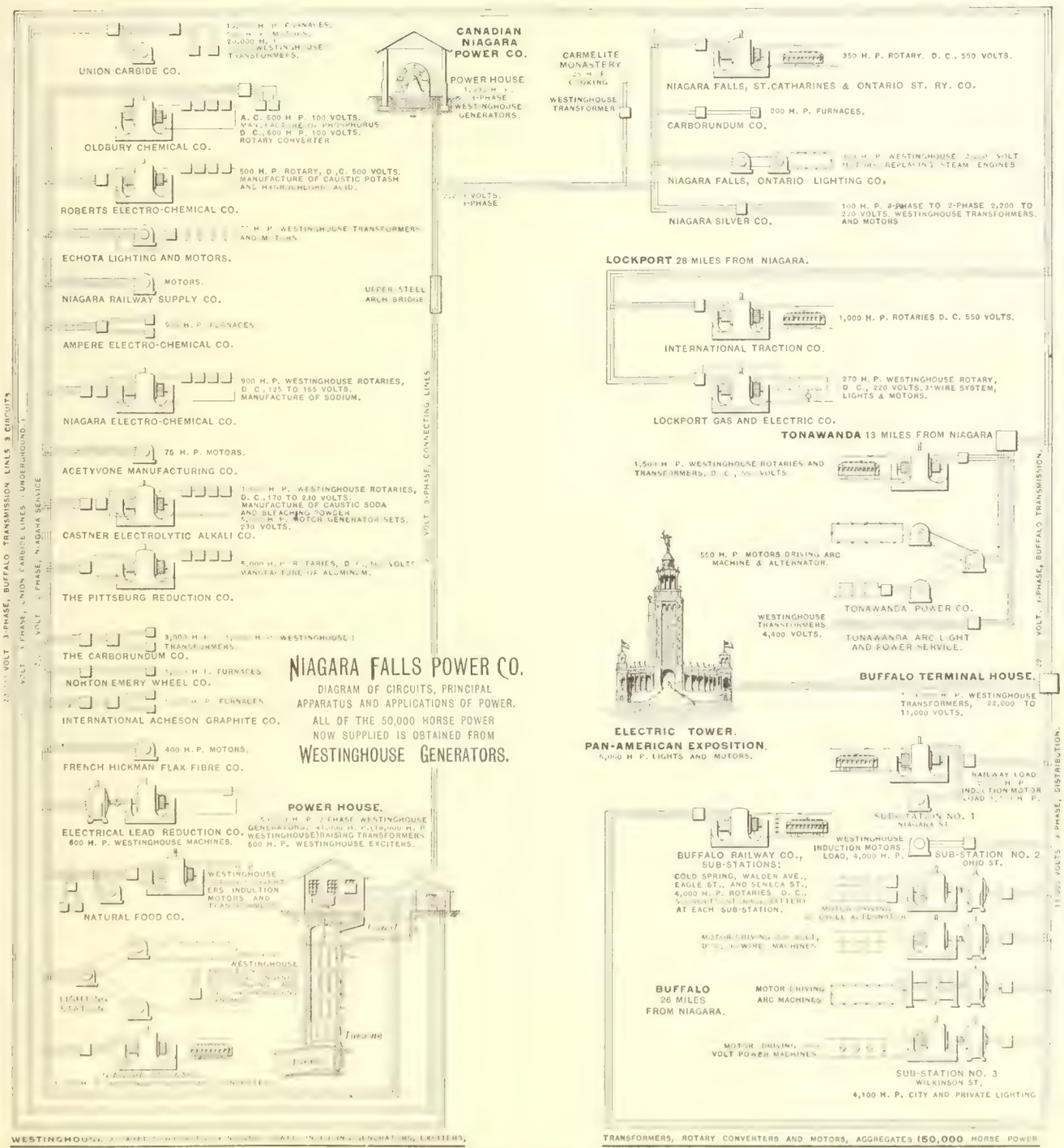
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SPARKS.

We are indebted to the Westinghouse Electric & Manufacturing Company for a plan of the Pan-American Exposition.

The Ottawa Electric Railway Company recently made a voluntary increase in the wages of motormen and conductors.

The transformer station of the Hamilton Electric Light & Cataract Power Company on Beach road, Hamilton, was destroyed by fire on August 8th.

The light commissioners of Brockville, Ont., have accepted the tender of the Irving Specialty Company to supply thirteen enclosed alternating arc lamps.

The city of Victoria, B.C., have awarded a contract to the Canadian General Electric Company for a sixty arc light Wood dynamo and fifty arc lamps.

It is said that another electric lighting and power company is about to be formed in London, Ont., and that the building of the Electrical Construction Company will be used as a power house.

The annual meeting of the Ottawa Car Company was held last month at which directors were elected. Mr. T. Ahearn has been chosen president; Mr. W. W. Wyley, vire-president and managing director; and Mr. James T. Fraser, secretary treasurer.

It is understood that a syndicate with Mr. H. A. Everett, of Detroit, and W. C. Ely, of Buffalo, as the chief promoters, is promoting a scheme to consolidate all the electric railways between Detroit and Toronto, and Hamilton and Niagara Falls. The Cataract Power Company of Hamilton is said to have been approached regarding the project.

The Canada Brass & Electrical Company, of Toronto, is about to remove to Guelph, and is now negotiating for a site on which to build a factory. The company was incorporated about two years ago to manufacture and install electrical apparatus of all kinds. The capital stock is $100,000. Mr. J. G. Howarth is manager of the company, and Mr. Arthur M. Brodie electrical engineer.

ELECTRICAL REPAIRS

In the large and well equipped factories where the manufacture of electrical apparatus is carried out under the piece work system, they find that repair work or apparatus sent in to be repaired or rewound interferes with this system, and in many cases they would prefer not to do this kind of work, as it is almost impossible to do it with dispatch and at a reasonable price. Knowing the above to be a fact,

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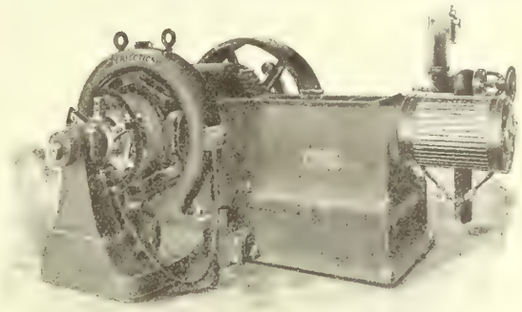
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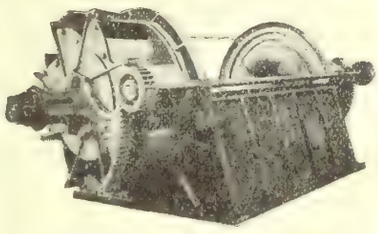
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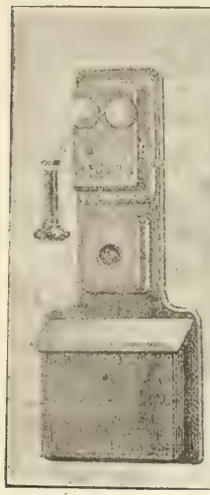
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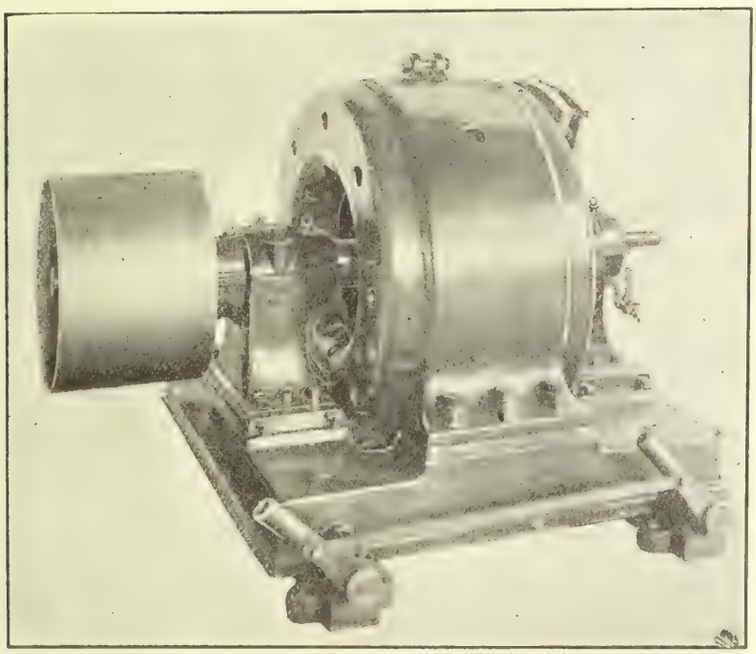
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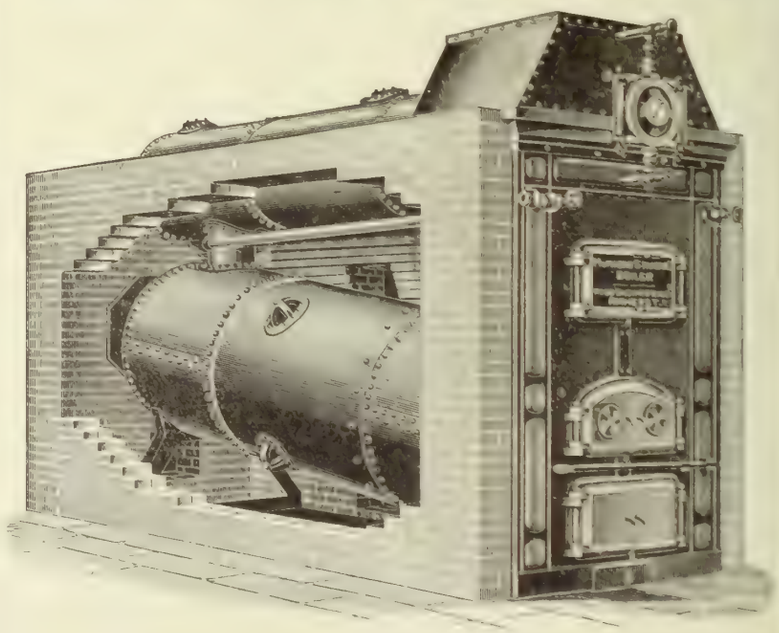
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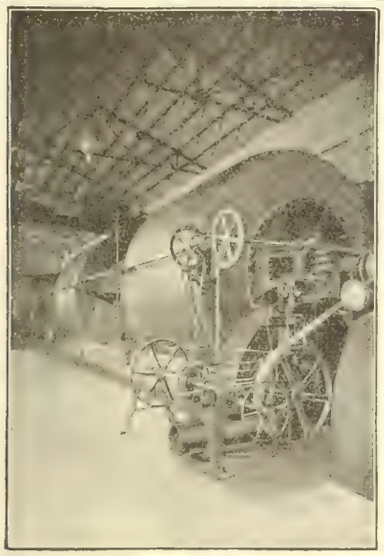
AGENTS: William McKay, 19 McKenzie Crescent, Toronto. Watson Jack & Co., 7 St. Helen St. Montreal.

Tenders have been invited by the town of Port Arthur, Ont., for the construction of a timber dam in connection with the Current River power development. The by-law to provide funds for this work received the sanction of the ratepayers last month.

It is said that the plant of the Sydney Electric Light Company at Sydney, N S., is inadequate to supply the demands made upon it, and the question of enlargement is under consideration. There is a feeling that the town should take over the plant and make the needed improvements.

The town council of Almonte, Ont., have made a proposition to Metcalf Bros. to purchase their water power, and if declined negotiations will be opened for the purchase of the Rosebank power. The power is desired for the operation of the electric light plant, about to be taken over by the town.

Messrs. Stone & Webster, electrical engineers, of Boston, are said to have signed an agreement with the Stave Lake Power Company to install a power plant at Stave Lake to cost $500,000, and to transmit the power to Vancouver and New Westminster. The British Columbia Electric Railway Company have, as previously stated, also applied for water rights for the purpose of developing power. The plant will be located at Coquitlam Lake, B.C., and will be used in supplementing their steam plant. The initial development will likely be 5,000 horse power, and the cost has been given as $500,000.



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WRITE FOR CATALOG. DEPARTMENT E.

SPARKS.

Telfer, Telfer & Company, electrical contractors, Montreal, have dissolved partnership.

J. R. Goodchild has been succeeded in the electric light business at Harrow, Ont., by R. Hilton.

The St. Catharines Electric Light Company, of St. Catharines, Ont., are making improvements to their plant.

The Canada Carriage Company, of Brockville, Ont., are installing an electric light plant for lighting their factory.

George H. Kendall has registered proprietor of the business of C. C. Hearle, manufacturer of boiler compounds, Montreal.

Norman Robertson has been appointed secretary-treasurer of the Walkerton Electric Light Company, as successor to W. A. McLean, deceased.

James E. Landall, a lineman in the employ of the Ottawa Electric Company, was severely injured on September 19th by falling from a telegraph pole.

H. N. Green, consulting engineer, of Montreal, was at Goderich, Ont., recently in the interests of the proposed electric railway to belt Huron County.

The town council of Cornwall, Ont., is considering the advisability of taking over the electric light plant and operating it under municipal control.

Farnham Bros., in the telephone business at Dunham, Que., have disolved partnership, and a new firm has registered under the name of Farnham & Turner.

The Hull Electric Company have been authorized by Parliament to run electric cars on the railway lines of the Ottawa, Northern & Western Railway Company.

The electric street railway at Belleville, Ont., was sold by auction on September 25th to Mayor Graham, for $6,750. It is understood that the purchase was made for Toronto parties.

At the annual meeting of the Toronto Suburban Railway Company a few days ago the old Board of Directors was re-elected and consideration given to the question of extending the road to Cooksville.

During the recent reception to the Royal party at Ottawa, the Ottawa Electric Company carried the largest number of passengers in its history. An approximate estimate places the number at 80,000 in one day.

The directors of the Toronto Railway Company are said to have adopted a resolution to increase the stock of the company $1,000,000 for the purpose of purchasing the Metropolitan and suburban electric railways.

The Renfrew Power Company, of Renfrew, Ont., accepted the tender of Mr. E. A. Cawsey for the construction of the proposed dam and power house. The work is under way and will be completed before the end of the year.

It is reported that local capitalists have under consideration the formation of a company to absorb the Wallaceburg Electric Light Company at Wallaceburg, Ont., and to establish a waterworks system in conjunction therewith.

The Stuart-Arbuthnot Machinery Company, of Winnipeg, has supplied two boilers to the Hudson's Bay Company, Winnipeg, for operating their electric light plant. The boilers were made by E. Leonard & Sons, of London, Ont.

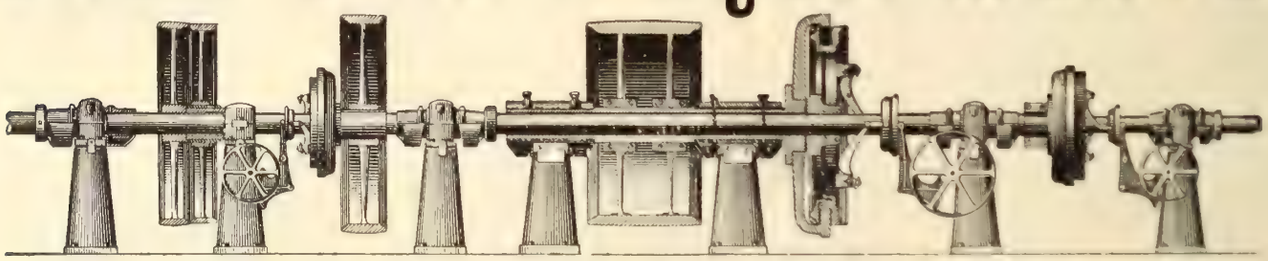
It is probable that a by-law will be submitted to the ratepayers of Winnipeg, Man., to provide funds for improving the electric light plant. James Stuart, water and light commissioner, states that another dynamo is necessary.

It is expected that in the United States during the coming winter a number of interesting trials will be made with electric lighting, among them being a considerable extension of the series enclosed alternating arc light system and the Nernst lamp.

Roland Miller, of Montreal, V. T. Rogers, of Ottawa, and others are seeking incorporation as the Canadian Power Company, the object being to supply light and power within the city of Montreal. The capital stock of the company is stated to be $25,000.

The Ampere Electric Manufacturing Company has been incorporated in Montreal. The incorporators are C. R. Whitehead, D. A. Pringle, R. E. T. Pringle, F. H. Leonard, jr., and E. E. Cary. The charter gives the company power to manufacture and sell electric apparatus and to generate electric power. The capital stock is $50,000.

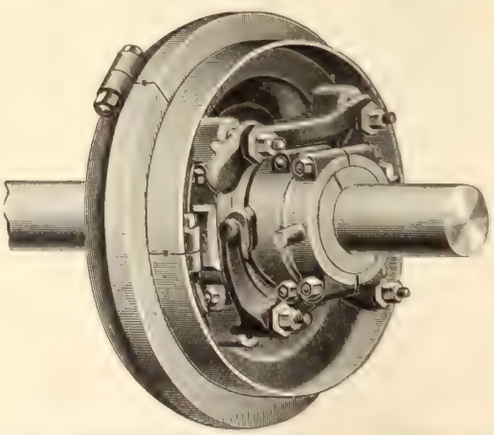
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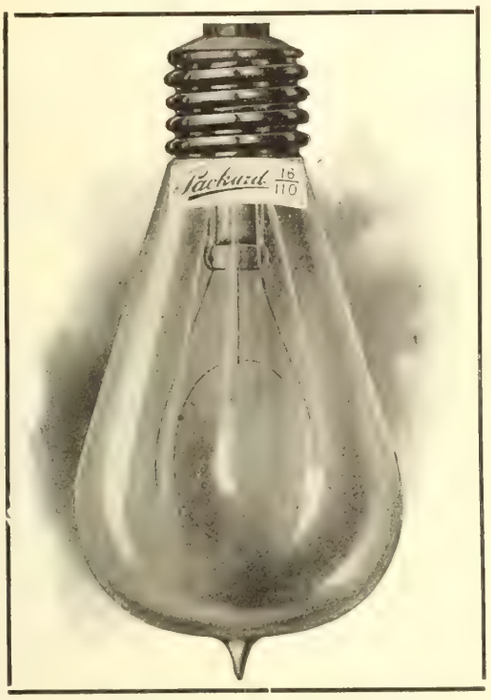
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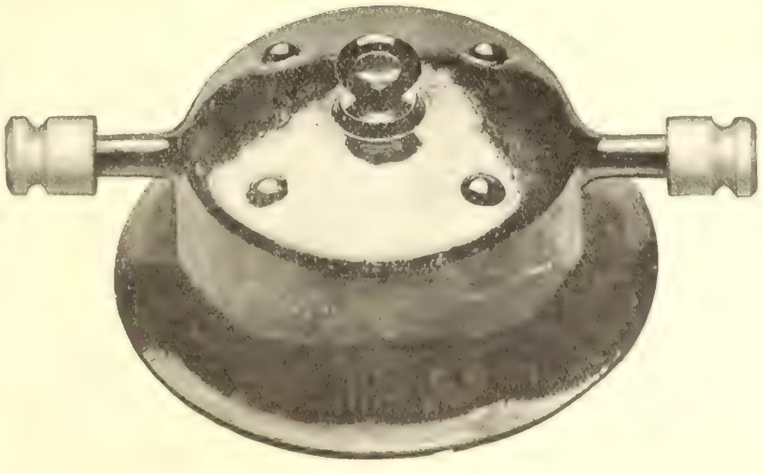
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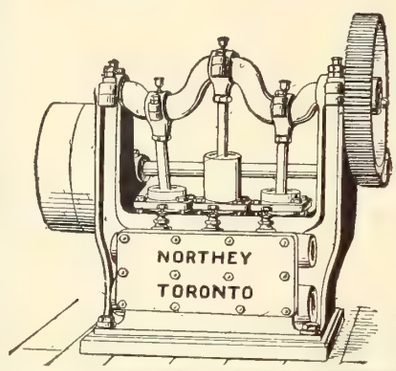
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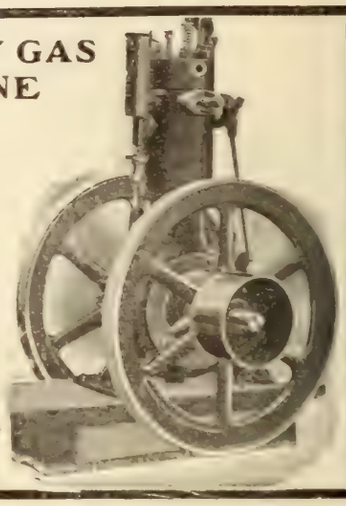
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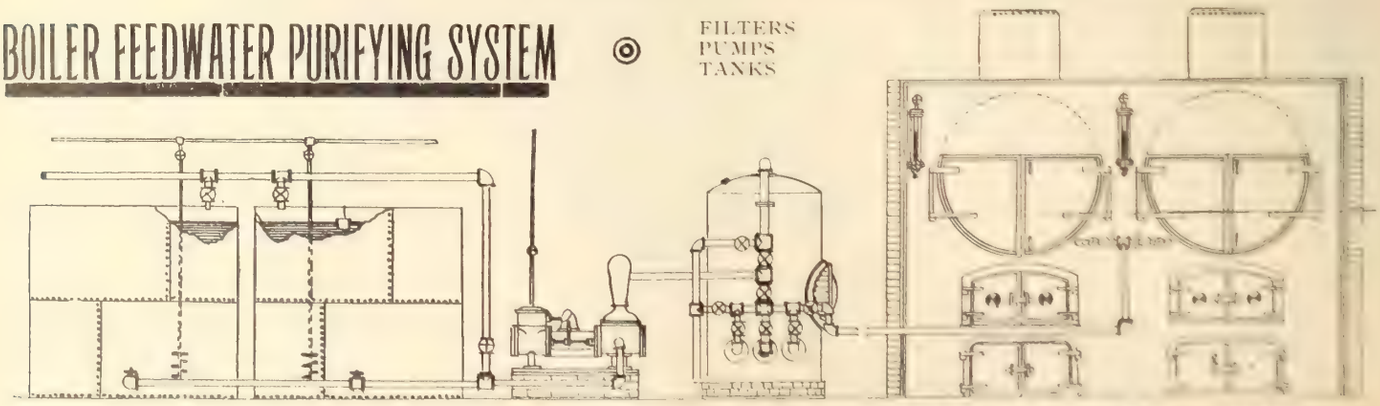
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CANADIAN

ELECTRICAL NEWS

AND

ENGINEERING JOURNAL.

VOL. XI. OCTOBER, 1901 NO. 10.

THE ASSUAN DAM IN EGYPT.

One of the most gigantic engineering works that has ever been undertaken is now in course of construction in Egypt. It is the building of an immense reservoir, the object of which is to provide perennial irrigation of Middle and Lower Egypt by raising the level of the Nile river, and thus to multiply the fertility of the land. The contract was let in the spring of 1898, and provided for the construction of two dams, one at Assiut and another at Assuan, within five years. The illustration of the Assuan dam, which we present herewith, is reproduced from Indian Engineering. This dam, the larger of the two, will cross the Nile river at a point where the First Cataract flows down into a narrow gorge, bounded on both sides by lofty rocks. The water above the dam will thus form a vast reservoir, whose waters will be stored in the flood season for use in the dry months. The total length of the dam will be over a mile and a quarter, and its height will be 345 feet above the level of the Nile at low water. It will be 80 feet wide at the base and 23 feet wide at the top. The wall is to be constructed of insubmergible masonry, built on a foundation of solid granite and pierced by 140 under sluices and 40 upper sluices. The provision of under sluices will prevent the deposit of silt in the reservoir. The amount of water to be stored is estimated at 1,065,000,000 cubic meters.



THE ASSUAN DAM, OVER THE NILE RIVER, IN EGYPT.

The dam will only slope outwards from the surface on its southern or reservoir side, which will have to resist an immense pressure of water. On its northern side it will be perpendicular. The upper sluices will be

lined with cast iron, and they, as well as many of the under sluices, will be worked by means of patent roller gates. The discharge at flood season will take place at the rate of 14,000 tons of water a second. The flood season, during which the water will be accumblating, lasts from about July to December ; it will remain stored to March or April, and will be used for irrigation purposes through the dry season, which extends from April to July. On the left bank of the river there is to be constructed a canal for navigation purposes, so that the dam will not interfere with traffic.

This great enterprise is being carried out by Englishmen. Sir Benjamin Baker, K.C.M.G., is chief engineer, and John Aird & Company, contractors. An English financier, in the person of Mr. Ernest Cassel, has advanced the necessary money, on the understanding that no liability would fall on the Egyptian Treasury until the profits from the undertaking should exceed the cost. The cost of the Assuan dam is estimated at £2,000,000, and it is calculated that the annual return to the Egyptian treasury will be £850,000, while the increased value of land in Egypt through the operation of the reservoir is estimated at £46,000,000. The total cost of the work, estimated at £4,800,000, will be met by annual instalments of £160,000, beginning on the completion of the dams and extending over thirty years.

ELECTRICAL ILLUMINATIONS.

Never before in the history of Canada has there been such an extensive employment of the electric light for illuminative and decorative purposes as upon the occasion of the present visit of their Royal Highnesses, the Duke and Duchess of Cornwall. There is reason for congratulation that in the development of electrical science this country has so far advanced as to produce the magnificent display that was seen in Montreal, Ottawa, Quebec, Toronto, and even in the cities west of the lakes. The electric light lends itself to decoration in a most pleasing manner, producing artistic and harmonious color effects.

The lighting companies were called upon to supply a vast amount of additional current, and they showed themselves equal to the occasion. Naturally, the largest number of extra lights were called for in the city of Montreal, where it is estimated that 45,000 lights were connected up for the display. The Royal Electric Company had connected to its mains throughout the city approximately 25,000 additional lamps ; they were used upon the principal business buildings and residences throughout the city, as well as upon the different arches temporarily constructed for the Royal visit. These extra lamps, as well as those of their general customers, were supplied from the power-house at Chambly. Although bad weather was encountered while the construction work was in progress, it is gratifying to learn that every one of the 25,000 lights were kept going throughout the entire time, and that the installation was a complete success. The Lachine Rapids Hydraulic & Land Company and its associate companies, the Standard Light & Power Company and the Imperial Electric Light Company, connected up about 20,000 extra lights. It is said that the additional lights did not tax the power-house to any extent, and if the company had had sufficient transmission lines and transformers they could have supplied 60,000 more lights, as they have over 3,000 kilowatts installed. About thirty prominent business places and residences were supplied.

The number of additional lights supplied for illumination in Ottawa by the Ottawa Electric Company was, approximately, 25,000. These varied from 5 to 16 candle power, averaging about 10 c.p., which at 56 watts would represent 1,400 kilowatts. These were used an average of twelve hours, altogether making a consumption of 16,800 k.w. hours. About 18,000 of these lights were used by the Government for illuminating the public buildings, the "Royal Alexandra" and "Laurier" bridges and Wellington street, about 2,000 by the Street Railway Company in illuminating the streets over their tracks, and the balance in private illumination. The illuminations in Ottawa were quite artistic, and were carried out with an eye to beauty and artistic effect. The architecture of the Parliament Buildings being Gothic, lent itself admirably to the illuminations, which consisted in outlines of the buildings. The lamps were so arranged that in day time at 100 feet from the building nothing could be seen, thus the architectural beauty of the buildings was not marred by fixtures, as is often the case. The lights were brought up to brilliancy very slowly, as is done at the Pan-American Exposition. This was one of the most beautiful features of the display.

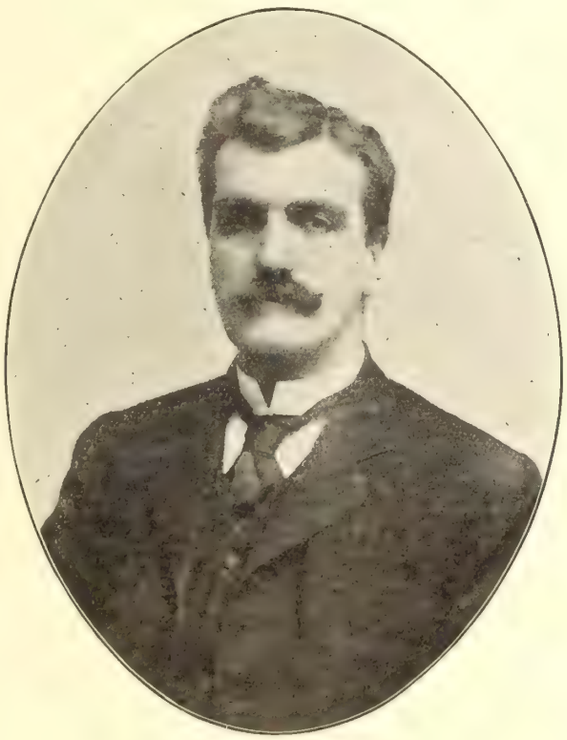
The historical city of Quebec, the first to be visited by the Royal party, was ablaze with electric light. The Jacques Cartier Water Power Company furnished about 8,000 incandescent lights for illumination purposes. These burned from dark to midnight during the nights of September 16th and 17th, and the energy consumed was between 4,000 and 5,000 k. w. hours, in addition to their regular load. The company were unable to obtain a sufficient number of transformers from the manufacturers, and therefore were obliged to use some 500 volt power transformers, which necessitated some of the installations having the lamps connected up in lots of five lamps in series, which worked very satisfactorily. In order that the illumination load would not affect the regulation of their regular lighting circuits, they connected them up onto the two sides of their two-phase power circuit in districts where this circuit was in reach. The Quebec Railway, Light and Power Company installed exactly 12,881 extra incandescent lights, aggregating 161,840 candle power and taking an extra current of 500 kilowatts. In addition there was a considerable temporary increase of 2,000 c. p. direct current arc lamps. The company had to refuse orders for about 5,000 extra lights on account of there not being sufficient time to install them. The extra lights did not in any way interfere with their regular customers, as they did not consume all the surplus currrent capable of being generated at the power station.

The Canadian Electric Light Company supplied 2,000 extra lights, of which 1,200 were 16 and 800 were 8 c. p. lamps. The largest installation by this company was for the Intercolonial Railway, and consisted of a luminous sign of eight foot letters, reading "Intercolonial Welcome." The most unique installation was the showing up of the outline complete of a schooner belonging to Messrs. G. T. Davie & Son. The stays, masts, gaff and hull were clearly indicated and presented a pretty picture. The signs were made of wood, painted white, mounted with cleat receptacle.

The electric lighting companies in the western cities did their part equally well. Just as we go to press the Royal party are about to visit Toronto, where the electric light will also form the main feature of the decorations. The Toronto Electric Light Company have wired up about 25,000 extra lights, while the illumination of the City Hall will be effected through the kindness of the T. Eaton Company, who have perhaps the largest private plant in the Dominion. The Temple Building and the Foresters' Arch will be illuminated by 14,000 incandescent bulbs, the power for which will largely be supplied by the private plant in the Temple Building.

MAJOR WALTER H. LAURIE.

Any man who has sufficient knowledge and experienee to run a donkey engine or even to keep a fire alight under a boiler will take to himself the title of engineer. There are very many who carry this designation worthily, but there are very few, even among those in prominent positions in engineering circles, who can be truly regarded as experts, possessing a thorough practical and theoretical knowledge of steam and the steam engine.



Major Walter H. Laurie.

Among the latter class a notable example is Major Walter H. Laurie, general manager of the Laurie Engine Company, Montreal, a gentleman who has for many years been regarded as one of the leading authorities in the Dominion upon steam engineering. The Major is a native of the Eastern Townships, and went to Montreal at the age of twelve years, and after serving his apprenticeship in the machine shops of Mr. George Brush, he started business in the year 1871 in partnership with his brother, Mr. John Laurie, and commenced building engines in the year 1873. Ever since that time the business has steadily grown both in volume and reputation, so that now the name "Laurie" applied to an engine has become the equivalent to a guarantee of high class workmanship and the assurance of the machine incorporating all the latest devices for getting the greatest amount of work out of steam. As an instance of the engineering skill of the Major and those associated with him, it may be mentioned that in several instances he has offered to build an engine to replace an old plant free of charge, taking as payment the amount of money saved in the reduction of the fuel bill for a certain number of days after the installation of his improved plant. Such an offer is always received with incredulity and doubt, but we know as a matter of fact, that in several cases where it was accepted the result was extremely gratifying and satisfactory to both parties.

The first engine built by the Laurie Brothers was, as above stated, in the year 1873, and was a small 4 horse power engine, for the St. Mary's College, Montreal, and was for the use of the boys of the school in their carpenter shop. Almost as soon as this one was turned out a second was completed, a 14 x 30 slide valve engine. It was in the year 1880 that the first Laurie Corliss engine was built. This engine is still in existence and good for work for some years yet. The engine which first brought the firm into prominence was the large 4,500 h. p. engine built for the Montreal Street Railway in the year 1895. This engine, when it was built, was the largest on the Continent, and attracted a great deal of attention, not only throughout Canada, but descriptions and illustrations of it with favorable comments appeared in several of the United States scientific and engineering papers. The fly wheel of this engine weighs 100 tons; the low pressure cylinder is 64 inches in diameter, and the high pressure cylinder 36 inches. Since that date big engines have been the forte of the Lauries, and their plants are to be found in the street railway power houses of Montreal (seven engines), Toronto, Winnipeg and Vancouver, also in the electrical power house of the Dominion Iron & Steel Company at Sydney, and many other places.

Until recently they have confined their attention to large work, but within the last three months have turned their thoughts to a smaller class of engine, and from what we can learn there is a great future before their new "Rival" engine, an engine of from 5 to 50 horse power. Mr. Laurie in an interview says that he has given more thought and study to the designing of this engine in proportion to its size than to any other, and in return he says that no engine which he has ever turned out gives him so much satisfaction from an engineering point of view, and from what we know of the Major we are satisfied that when he says a thing he means it.

Many of us are considerably bothered at times by the man who has a new patent that is going to revolutionize the industrial world. Major Laurie gets more than his share of such visitors, he being such a well-known authority in mechanical matters, what with the people who come to him on their own account and those who are sent to him by others who may become interested, it is rare for two days to pass without some such visitor appearing at his office door.

The business of the Laurie Brothers was merged into an incorporated company, "The Laurie Engine Company," in 1894, and since that date extension and improvement has been the constant history of the concern.

It will probably interest some of our readers to know that Major Laurie was gazetted in 1878 (after some years previous service in the ranks) to a lieutenancy in the Montreal Garrison Artillery. At this time he was well-known as a marksman, and in the year 1879 he won the first provincial championship badge competed for in the Province of Quebec for military rifle shooting, and in same year captured all the first prize medals in the province, together with two Martini-Henry Rifles and considerable cash prizes, and in the following five years he won more provincial medals and badges than any other marksman.

In the year 1885 he was appointed on the Wimbledon team, but did not go with them to England, as a call for active service in the North-West came, and he went through the North West-campaign. Major Laurie retired from active service in 1897.

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Correspondence is invited upon all topics coming legitimately within the scope o this journal.

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Electricity vs. Steam. At the recent convention of railway agents in Toronto, Mr. E. W. Judd, editor of the Railway Age, drew attention to the serious competition of the electric railways for passenger business. The almost completed electric railway route between Buffalo and Toronto, was used as an illustration of the developments which are in progress in this direction. The success of the electric roads would mean the ruin of many ticket agents. The only means suggested whereby the steam roads could meet the competition of the electric lines, was by heavy reduction in rates and the running of more trains. This plan was said to have been successful in bringing back business to the Boston and Albany railroad which had been lost to the electric roads. It is doubtful, however, whether all steam roads having electric railways as competitors would be able to stand the expense of such a policy.

The Royal Visit. Canada tendered a right Royal welcome to the Duke and Duchess of Cornwall and York, who have just left our shores after a month spent in visiting all parts of the Dominion. It is to the credit of our future King and Queen that they should have undertaken a nine months journey, traversing two-thirds of the earth's surface, with the object of acquainting themselves with the people and conditions existing in the various parts of the great British empire. The information which they have acquired will enable them to more capably discharge the functions of their high station. The people with whom they have come in contact feel the that bond of sympathy and loyalty which binds them to the Empire has been further strengthened. Great commercial advantage is also likely to accrue to Canada from the descriptions of the country and its resources and opportunities written by representatives of the leading British and American papers who accompanied the Royal party.

The Toronto Tehnical School. The Toronto Tehnical School has opened with the usual rush of students. The register shows that nearly 1,200 names have been enrolled since the opening of the session. This is the largest number in the history of the school and would seem to indicate that it is a much needed institution. The experience of the past shows, however, that a large proportion of those who enroll themselves as students at the opening of the school each year drop out of attendance at some time during the term. It would probably not be incorrect to say that the number of those who thus cease attendance at the various classes is not less than 50 per cent. of the total number enrolled. Owing to this condition of affairs the city is obliged to maintain a teaching staff for the instruction of the large number who enter the school at the beginning of each term, while a much smaller staff would suffice for the instruction of the students who attend the classes right through the term. The Board of Management will find it necessary to remedy in some way this condition. Probably the only remedy will be to require students to pay a certain sum on entering the school to be applied to maintenance account. This proposal has, we understand, been made at the meetings of the Board, but has met with strong opposition from the representatives of the Trades and Labor Council. We believe,

however, that some such step will have to be taken in the near future in order to avoid the waste of money which is now going on.

The Canadian Exhibit at Buffalo.

The impression given the visitor to the Canadian Building at the Pan-American Exhibition is that Canada is a purely agricultural country where buffalos, bears and all manner of wild animals abound. The building contains only specimens of grain, wild animals and furniture. While it is important that the advantages which we can offer to the farmer, the sportsman and the tourist should be adequately displayed, our capabilities in art and industry should also have prominence, otherwise strangers will receive a wrong conception as to our rank among the more highly civilized countries. It is true that the art gallery contains a small exhibit of pictures by Canadian artists, that in the Mining Building are to be seen some excellent samples of Canadian ores, and that in other departments such as live stock and farm and dairy products, Canada is well represented. But these exhibits are divided among various buildings and therefore do not impress the visitor as would a collective exhibit in one building. At least half the available space in the Canadian Building might profitably have been used for small, attractively arranged exhibits which would have served to give the visitor a bird's-eye-view of Canada's resources and development in a dozen or twenty different lines, and a measurably accurate idea of her advantages as a place of residence. People of refinement are loth to remove to a raw country, and it is to be feared that the character of many of the exhibits which we have made at foreign exhibitions has been such as to convey the idea that Canada is that kind of a country. Perhaps the best method of removing any such false impressions would be to inaugurate in Toronto on a suitable scale a Dominion Exhibition, and invite foreigners to come and see for themselves the beauty and capabilities of our country and the skill of our people.

A New Vapor Lamp.

One of the latest devopments in electric lighting is the Cooper-Hewitt Vapor Lamp, an invention which seems to follow pretty closely the lines of the Geissler tube. The lamp consists of a glass tube say three-quarters of an inch in diameter and two or three feet in length, or of such other dimensions as the requirements may demand—the dimensions of the tube being determined by various considerations, such as the E. M. F. and the current with which it is to be operated. The air is exhausted from the tube which is then filled with mercury vapor, through which a current of electricity is passed. The resistance offered by the vapor to the passage of the current causes the tube to become incandescent. The inventor claims to have discovered that the electrical resistance of a gas or vapor bears a definite relation to its density and that it is possible so to control the density of an enclosed gas or vapor acted upon by a current as to maintain that density at a predetermined degree, rendering its conductivity sufficiently stable and suitable for service as a light-giving medium, its efficiency in that respect being exceedingly great. Also that self regulation of the lamp may be attained by subjecting the gas or vapor path to such surrounding conditions as to secure the radiation of heat at a predetermined rate, or means for supplying additional vapor to the conducting material as its density becomes too attenuated. While it isclaimed that the Cooper-Hewitt vapor lamp,unlike the Geissler tube, is adapted to operate under prevailing commercial conditions, no details have been published to prove that such is the case to show wherein are its advantages over the incandescent lamps now in use. Some of the enquiries which naturally present themselves to the mind of the practical man are : What intensity of light will this lamp produce ? and more important still, what is the cost of its production ? Have operating tests been made under the usual commercial conditions ? If so, what results have been achieved ? It is all very well to be told that the new lamp "has been developed from a series of investigations highly scientific in their methods and conducted with great experimental skill." What central station owners and operators will want to know is, will the invention meet the requirements of every-day service more economically and satisfactorily than the arc and incandescent lamps now in use ? There is the possibility of a device being too "highly scientific" for this purpose.

The Storage Battery for Traction Work.

The experience of the Chicago Electric Traction Company brings out several facts which are of peculiar interest to those identified with electric traction. The decision of the company to discard the storage battery and employ the overhead trolley cannot be regarded as favorable to the former system, but is another step towards defining the conditions under which the storage battery can be employed economically. The road in question was built to demonstrate what could be done with the storage battery as a method of propulsion. It was decided to equip and operate a complete road rather than to experiment on roads already being operated by means of other systems. Skilled engineers were employed, and the power plant and road so constructed as to give the best possible results. The road composed about twelve miles of track, with three branches, making a total trackage of twenty-eight miles, consisting of ten miles of double track and eight miles of single track. The change to the trolley system was principally necessitated by the difficulty in operating the branch roads economically, as under the storage battery system it was necessary to run cars on the lines to the power house every trip for re-charging. The end of one branch being about eleven miles from the power house, it became necessary to install a supplementary charging station. A forty kilowatt generator, driven by a 50 horse power gas engine, was installed about two years ago, with the necessary equipment for handling the batteries. The additional operating cost necessitated by this sub-station averaged $400 per month. Considering that but eleven cars were being operated at the time, this was a large item of expense. It is said that everything in connection with the storage battery system worked successfully and smoothly from a mechanical point of view, but the operating expenses were very heavy. After being in operation for a comparatively short time, it was found that the batteries were worn out, and it was decided to put the required investment into an overhead system, which would be more permanent. The trolley road has been in operation for some weeks, during which time there has been a considerable saving in wages and depreciation. The

services of ten battery men were dispensed with, and but one additional attendant engaged for the power house. The experience of this company is an illustration of the necessity of carefully studying the physical conditions before employing the storage battery for railway work. Its usefulness in this field seems to be so limited that it is not destined to become a strong competitor to the overhead system. In a paper on "Notes on Modern Electric Railway Practice" read by Mr. A. H. Armstrong before the American Institute of Electrical Engineers, an opinion is advanced corresponding very closely to the practical experience of the Chicago Electric Street Railway Company. He says: "The storage battery is not adapted for an expanding system, and, furthermore, cannot successfully take care of long sustained over loads at the end of a suburban line fed from the city system."

THE CHAMBLY TRANSMISSION PLANT.

The power transmission plant of the Chambly Manufacturing Company is the subject of a descriptive article in a recent issue of the Electrical Review, of New York. It is characterized by the writer as one of the most interesting power transmission plants in North America. Some particulars are given regarding the transmission line and the operation of the plant which have not heretofore been published. Unlike the majority of transmission lines, it is composed of a considerable number of succeeding aerial and underground sections, as may be seen from the following table, giving the lengths in feet of each division of the line from the power-house to the receiving station in Montreal:

Aerial	5,400	feet.
Submarine	140	"
Aerial	68,153	"
Subway	9,200	"
Aerial	1,650	"
Subway	1,776	"
Submarine	285	"
Subway	1,015	"
Total	87,619	"

or 16.59 miles.

The sections marked submarine refer especially to crossings of the Richelieu canal and the Lachine canal in the city of Montreal. Along the length of the aerial line three strands of ordinary barbed galvanized iron fencing wire are strung, one being put at each end of the upper cross arm and one on top of the poles. This wire is mounted on pony glass insulators, although it is grounded at every pole by means of iron wires connected with iron earth-plates buried under the foot of the pole, the grounding wires being protected by an iron pipe passing down the side of the pole.

Near the terminal house at the Chambly end of the line is an arrangement whereby a load can be placed on one of the lines, for testing generators for example, by lowering metallic plates connected to the cables above end of the tail-race. An interesting result which has followed every test that has been made so far with this apparatus has been the killing of a number of fish in the tail-race as soon as the current is turned on.

The most interesting feature of the distributing station is the use of synchronous motors operated directly by the incoming line current, these machines being used for driving arc machines for street lighting at night, for working other machinery during the day, and running light with over-excited fields to compound out the induction factor of the line and bring up the power factor of the system to unity. By this method the power factor is kept normally as high as 96 per cent., the men at the switch-board having become very expert in regulating the field excitation of the balancing machines in order to bring about the desired results. Connecting with this distributing station are 125,000 16-c. p. incandescent lamps, 2,000 arc lamps, and a total capacity of 6,000 horse-power in motors. A large part of this power is furnished to the Montreal Street Railway Company, but a considerable quantity is used for operating induction motors for various purposes. A 550 h. p. induction motor is used for pumping water for a section of the city.

For motor service it has been found that contracts could be made with manufacturing establishments and others whereby the hours of work could be made to conform to the light-load hours on the station system, and that in summer both manufacturers and operatives were willing to work longer hours, while in winter shorter hours were practicable, the motor load of factories going off before the lighting load of the evening begun. The load curves, taken in different seasons of the year, show respectively average loads of 85 per cent. and 94 per cent. of the maximum load, and this extraordinary result has been obtained entirely by concessions to manufacturers and other power users who were willing to regulate their hours of work in accordance with the average demand of the city for power for all purposes. This result has been accomplished under the able management of Mr. Philip G. Gossler, the general superintendent of the Royal Electric Company. The new work of changing over the installation to 25,000 volts is progressing under the immediate supervision of Mr. Ralph D. Mershon, representing Mr. F. S. Pearson, consulting electrical engineer.

Editorially the Electrical Review makes the following comment upon the Chambly plant:

"The interest of this fine installation lies in the transmission line itself and in the method of compensating the low power-factor due to lagging currents and the method of protection against lightning.

"It is always interesting to see a deduction originally purely analytical made the basis of practical work of importance. The fact that over-excited synchronous apparatus would impart leading currents to the line with which it is connected or compensate out lagging currents has long been known, but its application has not often been practised, especiallly on such a scale as is exhibited in this transmission line. Notwithstanding the fact that the large total of six thousand horse-power in motors is operated upon the secondary distributing system in Montreal, the power-factor of the line has been held so nearly unity as practically to cause no trouble of any kind, and the full utility of the plant has been made available without excessive cost. It is also of interest to note that in four years of operation, generating directly a potential as high as twelve thousand volts in the dynamos, there has been no accident worthy of the name from electrical causes. This is practically a demonstration of the permanence of high-tension apparatus, and shows that its depreciation is nowhere nearly so high as was expected at the time the plant was laid down.

"Occasion was taken in these columns last week to refer to the barbed-wire lightning protection which has

proved so entirely successful upon this line. It seems somewhat astonishing to see a transmission line upon which so much depends absolutely devoid of the usual lightning-arrester apparatus. Experience, however, is the best teacher, and the protection which has been obtained from the simple barbed fence wire has proven entirely adequate and, indeed, superior probably to that which could have been had from other and more elaborate appliances. While this is in no sense an argument against the lightning arrester as ordinarly constructed it is certainly interesting to those who have to maintain long-distance high-tension transmission lines, and it suggests an easily applied and obvious remedy for many of the troubles that have beset such installations. Of course, it is not possible to use barbed wire in all situations, and there is a wide field for the lightning arrester ; but for the cross-country line it seems that the experience of the Chambly-Montreal line has shown that the barbed wire is perhaps the best protection yet discovered, and certainly the simplicity and ease of application of this form of lightning guard will commend it."

QUESTIONS AND ANSWERS

"R. F." : What is the difference between priming and foaming?

Ans.—Priming is the name given to that state of the boiler when the water is picked up, in the form of spray, by the steam, and carried over to the engine or other machinery in which the steam is being used. It is caused by too heavy a demand being made on the boiler for steam, or by the steam spaces and channels being too small for the amount of steam required to be passed through them, and may exist in a boiler supplied with the cleanest water, whereas foaming is due to dirty water and consists of a violent agitation of the water in the boiler, due to the presence of impurities, such as grease and salts. Both are dangerous to the engine because they are likely to result in water getting into the cylinders, with all its attendant disastrous results ; and to the boiler because they are likely to result in low water and overheating of the boiler plates.

R. T. Davis : What is the usual rule for figuring out the capacity of the engine for driving electric dynamos?

Ans.—Dynamos are usually rated in kilowatts output, a kilowatt being, as the name indicates, 1,000 watts, and as a horse power is 746 watts, every kilowatt output from the dynamo is equivalent to 1⅓ h.p., the input to the dynamo being greater than this by the losses in it, or say, five to nine or ten per cent. larger. If the engine and generator are direct connected, the input into the generator is the output from the engine, which is the figure required to be found, but if the two are belted, it will have to be further increased by an amount corresponding to the losses in the belts, which will be another seven to fifteen per cent., depending on whether or no countershafting is used. After we have found by the foregoing the engine power required to drive the dynamo at its rated full load, it is usual to take into consideration the question as to whether the unit is likely to be called on to carry any sustained overloads; if they are likely to be but temporary, and unusually close speed regulation is not imperative, the engine, having a wide margin in its cut off, is generally quite able to carry them without difficulty, if of the horse power (at normal cut off) given by the above rules.

"J. M." : I have a compound wound dynamo lighting our shops, and want to arrange it to run as a motor and help the engine at short intervals during the day; what changes will be necessary to make in the connections? What horsepower can I get from it? Its capacity is 500 lights.

Ans.—If you desire to run anywhere near the full capacity of the machine, it will be necessary to provide a switch which will either short circuit or else cut out entirely the series field coils ; if left as they are the machine will in all probability tend to spark badly and to run too fast. You will have to provide a starting rheostat in addition to the field rheostat, with which we presume you are already equipped, and also a switch for bringing the circuit from which you are going to run it to the motor, provided you have not already got one in for throwing the lights onto this foreign service instead of your own machine. If you have a switch which performs this service you can by charging the connections slightly make it do the work without going to the expense of adding others. If the lamps you are running are of 60 watts, the machine as a dynamo runs an output capacity of $500 \times 60 = 30$ kw., which is also its input capacity as a motor, the output capacity as a motor being from 12 to 8% less, depending on the efficiency of the machine, which will likely run somewhere from 88 to 92% at full load, depending on the make and age, and taking 10% as an average figure, will give you a 27 kw. or 36 horse power as the net output of the machine when operated in this manner.

"Student" : What is the object in installing storage batteries where generators are already in use?

Ans.—Storage batteries are usually installed for one of three reasons : first, to obtain an absolutely steady voltage ; 2nd, to assist the generators over the peak of the load ; 3rd, to lessen the operating charges of a plant by lowering the wage account. The plants installed for the first service are as a rule small and comparatively unimportant from a commercial point of view, being used for calibrating instruments or for research work. Batteries installed under the second heading are put into those plants whose power or lighting load is at its peak, beyond the capacity of the generators installed, though well within their output at other times, in which case the batteries are charged during the hours of smaller demand and discharge in parallel with the machines at the peak. The same holds true of railway work, which to-day is perhaps the storage battery's greatest field, with the exception that as the demand on the bus bars varies tremendously from minute to minute the battery is in like manner continously being charged or discharged simultaneaously, with a falling or rising demand from the feeders for current, the object in both types of service being to reduce the generator capacity which would otherwise be necessary, and to keep the load on them and their driving engines as nearly uniform as possible, a necessary condition of maximum or even good economy. Plants put in under the third heading are generally left alone during the night hours to take care of the small number of lights which are usually required during that time without the necessity of paying an attendant to be present, as would be the case were engines and generators to be kept running during that time.

CONVENTION OF OLD-TIME TELEGRAPHERS.

TWENTY-FIRST ANNUAL RE-UNION OF THE OLD-TIME TELEGRAPHERS' ASSOCIATION AND THE UNITED STATES MILITARY TELEGRAPH CORPS.—PIONEERS RELATE MANY INTERESTING REMINISCENCES.

The "pioneers of telegraphy," to the number of several hundred, gathered in the city of Montreal on Wednesday, September 11th, the occasion being the twenty-first annual meeting of the Old-Time Telegraphers' Association and the United States Military Telegraph Corps. For the first time in the history of these societies the meeting was convened outside of the United States, this to mark the "coming of age" of the societies and in recognition of the number of members who are now located in Canada. The membership of the Old-Time Telegraphers' Association is upwards of one thousand, and embraces many telegraphers now prominent in other walks of life. The United States Military Telegraph Corps is composed of veteran telegraphers who were engaged as army operators during the Civil War.



CONVENTION OF OLD-TIME TELEGRAPHERS' ASSOCIATION, MONTREAL, SEPTEMBER, 1901.

The programme of entertainment furnished by the local committee was of an excellent character, and such as to prove the ability of Canadian cities to entertain in an equally hospitable manner with the cities of the United States. Mr. L. B. McFarlane, president of the Old-Time Telegraphers' Association, received the hearty support of a large committee, and had made every arrangement for the entertainment and comfort of the visitors.

The opening proceedings consisted of an informal social meeting of the members of both societies in the Ladies' Ordinary at the Windsor Hotel. Col. William B. Wilson, president of the Military Telegraph Corps, presented Mr. L. B. McFarlane with a souvenir badge formerly owned by inventor Morse and donated to the Association by Mr. J. Reid.

Mayor Prefontaine welcomed the visitors to the city in an appropriate address. Col. Wilson replied, thanking the Mayor for the hearty welcome that had been extended to them, whereupon the Mayor was made an honorary member of the association.

Business sessions were held during Friday. The project to establish a Telegraphers' Home was discussed, and it was decided that it was not expedient for the association to undertake the building of a home at the present time. It was decided to hold the next annual meeting at Salt Lake City and Ogden.

The Telegraphers' Association elected the following officers: President, George H. Corse, of Ogden; vice-president, Belvidere Brooks, of Denver, Col.; secretary-treasurer, John Brant, New York.

The Telegraph Corps re-elected its officers for the coming year: President, Col. William B. Wilson, of Philadelphia; vice-president, William M. Ives, New York; secretary-treasurer, James E. Pellit, Chicago.

The visitors drove around the city and up to the mountain during the afternoon, and were entertained to luncheon by the Mayor.

Thursday and Friday were devoted to pleasure. Visits were made to the electric lighting and power stations and a trip was taken on the steamer "Duchess of York," shooting the rapids and making an inspection of the harbor of the city. Owing to the unfavorable news received from the bedside of the late president McKinley, it was decided to cancel all appointments made for Friday afternoon. Some of the delegates made the return trip by steamer to Quebec.

THE BANQUET.

The feature of the convention was a banquet held in the Windsor Hotel on Thursday evening. This was a most pleasant and successful function. Mr. W. C. Burton, of New York, presided. On the walls were the names of Morse, Galvani, Edison, Thompson, Faraday, Ohm, Reid, Bell, Franklin, Volta, Preece, Wheatstone; and facing the chairman were the words "Old-Time Telegraphers, '73." In the centre were the union jack and the stars and stripes, while flags of many nations were tastily arranged around the windows. The menu was excellent and served in an admirable manner. Toasts were drunk in honor of King Edward and the President of the United States, following which came several informal speeches.

A talk on "Old-Time Reminiscences" was given by Mr. H. P. Dwight, of Toronto, the general manager of the Great Northwestern Telegraph Company and the father of Canadian telegraphy. Mr. Dwight said:

"I have never, until now, found it convenient to attend any of the meetings of the Old-Time Telegraphers' Association. As it was arranged that the meeting this year should be held in this grand old historic city of Montreal, and as it was here that I began my

career as a telegraph operator fifty-four years ago, and as the time has arrived when I presume there can be no doubt as to my qualifications as an Old Timer, I thought it a duty, as well as a pleasure, to be present on this occasion. Looking around the table reminds me of what I have sometimes noticed in connection with some "Young Men's" Associations, the members of which are often old and gray-headed, and sometimes bald-headed men. Our "Old Timers," I should judge by those I see around the table, are some of them what might be called comparatively young men. That, however, depends altogether upon the point of view. When I was twenty or twenty-five years of age, or thereabouts, I thought a man of forty or forty-five a pretty old man, but as I grew older myself, I gradually changed my mind as to the old age date, until I have now come to think that a man of even seventy or seventy-five years of age is not a very old man after all, and a man of forty or thereabouts a mere boy. The younger men present, however, who may be disturbed as to their qualifications for membership in the Old-Time Telegraphers' Association on the score of age, need not worry about the matter. You will wake up some morning before long, my young friends, and be surprised to find that you are seventy years of age, and you will begin to think that there must be some mistake about the matter ; and you will hunt up the old family Bible to see about it, and you will find the "Gospel Truth."

"The newspapers are beginning to refer to me as "The Father of Canadian Telegraphy," and I do not hesitate to say that I am very proud to be so called. I confess that I am, in fact, vain of the title. But if I am in any sense the "Father of Canadian Telegraphy," the "Grandfather" is Mr. O. S. Wood, who was Professor Morse's first pupil, and was the first superintendent of the Montreal Telegraph Company, and is still living in retirement, a useful and honorable life—85 years of age—one of the purest and best of men, honoured and beloved by all who know him. We might take him for our Patron Saint. I said that I was glad to be called "The Father of Canadian Telegraphy." Every man is proud to be the father of a numerous and respectable family ; and I can point with pride to the numerous progeny in the business who have grown up under me, occupying respectable and prominent positions, not only on the lines under my charge throughout the Dominion, but on other lines in Canada and in the United States—to say nothing of others who have left the service, and are filling honorable positions in other walks of life. It has been a great pleasure, and I have been very proud to hear, as I have done from time to time, favorable reports from telegraphic superintendents in the United States of our Canadian operators in their service.

"This is not the time or place, however, for long speeches; and I have little more to say. I don't know how my brother Old Timers feel, but for my part, I feel a very great pride and satisfaction in having been connected with an enterprise which we may proudly claim to have done more than any other to facilitate the business and promote the comfort and happiness and peace of the world ; and I take this occasion to congratulate every Old Timer present, who is still or has ever been connected with the business, on such an honorable and useful service as it has been our good fortune to be engaged in.

"I hope our brother Old Timers from the other side of the line have been pleased with their visit to the Dominion, and to Montreal. We think we have one of the best countries on the face of the earth ; I will not say the best, because I would not like to be lacking in politeness to our freinds by saying that we have a country better than their own. These international gatherings serve a much wider purpose than merely social intercourse, in promoting the friendly relations between Canada and the United States. It is pleasant to know there is such a friendliness, and that it is constantly increasing. In fact, "Uncle Sam" and our "Lady of the Snows" are getting to be very intimate, and judging from all that we see, the more they know of each other, the more friendly they are likely to become. Nowhere in the civilized world was the news of the attempted assassination of President McKinley received with greater horror and indignation and sympathy than in Canada, and Canadians are proud to-day in knowing that a Canadian physician and Canadian nurse are at President McKinley's bedside. "One touch of nature makes the whole world kin."

"What the ultimate result may be, it is hard to say ; but it would not be surprising if, sooner or later, "Uncle Sam" might be found to have serious intentions—probably a proposal may be made ! If matters ever reach such a point, I think I can tell pretty well what the reply of our "Lady of the Snows" is likely to be. I fancy it would be something to this effect : "Uncle Samuel, you are very good looking, and are very smart, and you are prosperous, and all that, and I feel greatly flattered ; and I have no hesitation in consenting to be your sister." The fact is, that "Uncle Sam" and our "Lady of the Snows" are getting to be about as familiar as they can well be, without occupying the same apartment ; but I am afraid that our "Lady of the Snows" will draw the line there."

Mr. William Maver, of New York, followed with a short address as an Old-Timer and a Montrealer. Thirty years ago he travelled every street in Montreal, as a messenger, at one cent a message. The line of promotion was from messenger boy to delivery clerk and then into the operating room. He referred to the great difference in the systems of old Montreal and those of to-day.

Mr. M. J. O'Leary, secretary of the Telegraphers' Mutual Benefit Association, spoke of the greatness of fraternalism, and Hon. A. M. Mackay, general superintendent of the Anglo-American Telegraph Company at St. John's, Nfld., followed as one of the oldest of Old-Timers. Mr. Mackay has been in the employ of the Anglo-American Cable Company for forty-five years. He was formerly an operator of the Montreal Telegraph Company and claims to be the first man to take a message by sound. He spoke as follows :

"I may be characterized as an "Old-Timer," because my connection with the telegraph dates from the 4th of June, 1850. I took charge of an office on the 12th of September of that year, so that our meeting here to-night is the anniversary of my fifty-first year of actual telegraphy (applause). One month afrerwards I dispensed with the use of paper in the Morse instrument. It has been claimed that another person had already dispensed with paper in that connection. If there was another person prior to the 14th of October, 1850, that copied messages by sound, he is prior to Mr. A. M. Mackay ; if he is subsequent to

that date, then he is subsequent to Mr. A. M. Mackay (applause). I came to Montreal in 1854, but before getting permission to work I was permitted to undertake the duties provided I would permit an overseer to see that I made no errors in receiving by sound.

"I will now, if you please, refer to a matter more interesting to you all. I mean the Atlantic Telegraph, a subject that always occupies a large share of attention, because telegraphing by cable is one of the most important factors of the whole service that makes the telegraphy of the world so valuable. The subject I want to mention to you is the question as to "who was the person that initiated or gave birth to the idea of an Atlantic Telegraph, and to all deep sea and long distance telegraphy?" Where this subject has been given attention it is claimed that the Rev. Dr. Mulock, Roman Catholic bishop of Newfoundland, was one of the parties. Others contend that the late F. N. Gisborne is the person, and others that Cyrus Field should have the honor. I would refer to these three gentlemen, beginning with Dr. Mulock. My opinion should be worth something, as I am the only living man of those connected with the Atlantic cables at their inception in an executive capacity. There is not the least doubt that Dr. Mulock got his information from Mr. Gisborne, and that his only connection with telegraphy was the expression of his belief in the possibility of its establishment. There is no doubt in my mind, therefore, that the honour lies between F. N. Gisborne and Cyrus Field. Gisborne's friends contend that he was unjustly treated by Mr. Field, and that he really advised Field of the possibility of accomplishing this great work. Mr. Gisborne did not make that contention in his lifetime. I saw him long subsequent to the establishment of the Atlantic Telegraph, and he said that on meeting Cyrus Field in January, 1854, while foreshadowing the possibility of establishing Atlantic communication between Newfoundland and the continent of America, he did not refer to a cable to England, but only relied on the success of that enterprise by contributing messages from steamers arriving from Newfoundland and transmitted from Newfoundland by carrier pigeons, and ultimately by telegraphic cable. Gisborne made this statement, and admitted that he did not on his first interview with Cyrus Field foreshadow the possibility of the Atlantic Telegraph.

"Mr. Field being questioned in regard to that interview, which took place in 1854, said exactly the same thing. He only contended for the pigeons in the first place, and the possibility of a cable to Cape Breton in the second place, and he considered that there was no possibiliy of such a scheme ever paying, and, therefore, he would not have anything to do with it. But on seeing Gisborne he turned over the Globe, and seeing that Cape Breton was only an inch or two on the globe from Newfoundland, and Ireland only six inches, he said at once "if a cable could be laid to Cape Breton, why not to Ireland." The next morning he wrote Professor Morse and asked him if a cable could be laid to Ireland whether it could be worked. Concurrently he wrote to Lieut. Morley, of the United States Navy, and asked him if it would be possible to lay a cable to Ireland. Satisfactory answers being obtained to these two questions, he at once embarked in the enterprise, and threw his whole influence into the work of laying the Atlantic Cable. Gisborne did not communicate the idea of an Atlantic cable, but he communicated the idea of a cable. That was enongh for a man of Field's foresight and ingenuity. So there is really no difference as to the credit due these two gentlemen for the initiation of the project. I think I am the only living witness to these facts, and I am glad to have this opportunity to state it publicly.

"Who, then, was the author of the first idea of the Atlantic Cable? In 1854 the New York, Newfoundland and London Telegraph Company obtained a charter with exclusive rights to land a cable in Newfoundland. I am confident that this exclusive right will never be renewed, as I am sure that the British Government will never consent, now that deep sea telegraphy is an assured fact, to exclusive rights of that nature being conferred on any corporation. I find no difficulty in naming the man who first started the idea of an Atlantic cable. Mr. Gisborne in 1850 showed me letters at that time from Mr. Brett. There were two Bretts. I think the first was John and the second Jacob, but it was the older Brett who was in communication with Mr. Gisborne, and he had given birth to the idea of a cable. He not only gave birth to it in 1850, but in 1852 laid the cable from Dover, in England, to France, and that cable was working until within a few years of the present time. He not only gave birth to the idea, but gave actual presence to the cable, and I think it is not unlikely, and I find it easy for me to say that there never was an inventor who was wont to appreciate his own invention. I think it is not unlikely that Brett, when he had the idea of a cable at all, although only 21 miles in length, that he had within his vision thousands of miles, covering all waters and all seas. My idea is that John Brett was the originator and inventor of the submarine cable.

"Colonel Wilson has made reference to the fixity of purpose, the absolute security, and the trustfulness that it put in telegraphers. I think it is fair to all the telegraphers with whom I have been connected, having passed under my supervision millions of telegrams within the last 51 years, and I have never known one single instance where the trust in a telegrapher has ever been betrayed. (Prolonged applause). There has not been a single instance in all my life where I have had the least knowledge or suspicion of a message having been wilfully divulged.

"It has been a great pleasure to me to come here on this occasion, and my anticipations have been more than fully compensated. I have by virtue of the Association badge taken the liberty of speaking to many ladies without an introduction, and I must say that they have treated me with the greatest courtesy and kindness the same as if they had known me, relying on my membership, and probably on my ancient and respectable appearance. (Laughter and applause).

Brief but clever speeches were made by Col. D. W. Wilson, of Philadelphia; Senator Ives, vice-president of the Military Telegraph Corps; Mr. W. McLea Walbank, manager of the Lachine Rapids Hadraulic & Land Company, and W. C. Burton, of New York.

The proceedings of the evening were dispersed with songs. Messages were received and read at the banquet from the president and the vice-president elect acknowledging the honor which had been done them.

Mr. John Horn, of Montreal, exhibited many valuable telegraphic relics which he has in his possession, including original letters and telegrams written by "Father" Morse.

AWARD FOR AN ELECTRICAL EXHIBIT.

On this page is shown a fac-simile of the certificate accompanying the Gold Medal awarded to the Canadian General Electric Company, of Toronto, by the directors of the Toronto Industrial Exhibition for their very comprehensive exhibit at the recent exhibition, which was illustrated in our September number. An interesting feature of the Medal is that it bears on its face the words "In Commemoration of the Accession of Edward VII, Rex. et Imperator, 1901." It was, of course, in view of the change necessary to make a special die for this year's issue of medals, but by doing so they are distinct from every other issue. It is understood that this is the first time that a Gold Medal has been awarded by the Toronto Industrial Exhibition Association for an exhibit of electrical apparatus.

PERSONALS.

Mr. J. J. Franklin, some years ago manager of the Montreal Street Railway, died in Toronto last month, at the age of 54 years.

Mr. S. Sotomayor, of Chile, South America, has been in Canada recently looking into the utilization of water power for electrical purposes. In Chili, notwithstanding that there are abundant water powers, they have been employed but very little for electrical purposes

Mr. F. W. Martin, superintendent of the Hamilton Electric Light & Cataract Power Company, has been appointed manager of the Lincoln Light & Power Co., of St. Catharines. Mr. Martin is held in high esteem by the officials and employees of the Cataract Power Company, and upon tendering his resignation he was presented with a handsome gold watch and chain and a Masonic charm. The presentation was made by Mr. Gordon J. Henderson, superintendent of the lighting department, and was acknowledged in words of appreciation by Mr. Martin.



BY THE WAY

In the entrance to the Electricity Building at the Pan-American Exhibition are displayed a number of "first" things in electrical devices. Among them is an arc lighting machine, labelled "First Arc Machine used for public lighting—date unknown." I am told that the machine was manufactured in Philadelphia by Mr. J. J. Wright, now manager of the Toronto Electric Light Co., and that on one of the brass set screws may still be seen his mark made with a file at the time the machine was manufactured. Mr. Wright could no doubt supply the missing date and in addition much interesting historical matter relating to this and other devices invented by himself, Prof. Elihu Thomson, and other pioneers of the electrical industry. But his well-known modesty forbids.

Mr. George C. Rough, manager at St. John, N. B., for R. E. T. Pringle, of Montreal, has been suceeded by Mr. Irving Smith, who for some years was with the Canadian General Electric Company.

TRADE NOTES.

The Electric Repair and Contracting Company, Montreal, Que., recently installed the wiring for 150 lights for the Royal Shoe Company and 230 lights for the Geo. Slater Shoe Company, Maisonneuve, Que.

John Forman, dealer in electrical apparatus and supplies, Montreal, Que., supplied all the Imperial transformers for the recent electrical illuminations in Quebec, over 13,000 lights being used. These transformers are manufactured by the American Transformer Co., New Jersey, Mr. Forman having the Canadian agency.

Messrs. Munderloh & Co., manufacturers of electrical supplies, Montreal, have just issued a neat and attractive bulletin illustrating their new "Solar" alternating current multiple arc lamps. This company claim the Solar lamps have given universal satisfaction wherever installed, and that they are being placed where most other alternating current multiple arc lamps failed to give satisfaction. They are handsome in appearance, well made and efficient.

During the recent illuminations in Montreal the Sayer Electric Company, in their arrangement of lights on the buildings entrusted to them, did some of the best work done in the city. As a proof of this the following buildings and houses may be mentioned: City Hall, Canada Life Building, St. James street; Star Building, Bank of Toronto Building, residences of R. Wilson-Smith, Sherbrooke street, H. Graham, Sherbrooke street, R. Stanley Bagg, Sherbrooke street, and G. H. Burland, Sherbrooke street.

ELECTRIC RAILWAY DEPARTMENT.

A ROYAL TROLLEY CAR.

Upon the occasion of the recent visit of the Duke and Duchess of Cornwall to Ottawa, they were transported from Rideau Hall to the Chaudiere in a trolley car provided by the Ottawa Electric Railway Company expressly for the use of their Royal Highnesses. It is fifty feet in length, straight sides, and vestibuled at both ends, with full monitor roof of the Pullman pattern. The color is also Pullman standard, with the British coat-of-arms in gold conspicuous on both front and rear.

The interior of the car, shown herewith, is finished in antique polished oak, the ceiling being covered with three-ply bird's eye maple veneer, and decorated. There are four large British plate mirrors set in frames, two at either end of the car. All trimmings, such as hat racks, hooks, etc., are of solid bronze. The window curtains are of the latest design, and are very ornamental. The car is brilliantly illuminated by five clusters of incandescent electric lamps, twenty-one in all. The floor is covered with a rich, Royal blue velvet carpet. The car contains fourteen large easy chairs beautifully upholstered in olive green plush. The trucks are double, and of the swing motion pattern



Interior Royal Trolley Car.

with graduated springs. The electric equipment is very complete, and consists of four Westinghouse 50 h. p. motors. The car is also fitted with the Westinghouse automatic air brake, and is capable of attaining a speed of fifty miles an hour. It was manufactured by the Ottawa Car Manufacturing Company.

NEW TYPE OPEN CAR.

A new style of open car has been in operation the past summer by the Montreal Park & Island Railway Company, of Montreal, and the London Street Railway Company, of London, Ont. It consists of a 15-bench open car, one side of which is the same as that of a closed car. It has a seating capacity for 75 persons. It is geared to run at a speed of 45 miles an hour, and is mounted on double trucks of the company's standard, which are equipped with Westinghouse 38 B motors. The length of the car over all is 43 feet 6 inches, width about 7 feet, and height from floor to ceiling 7 feet 6 inches. On one side the car is closed to a height of 3 feet 3 inches from the floor, and the upper part of this



New Type of Car.

side contains sashes making two half windows, the upper panels being stationery and the lower ones opening upwards. The other side of the car is entirely open. A view of the open side is herewith shown.

Grab handles are placed on each post on the open side of the car, and each seat is also supplied with a grab handle. The seats are 18 inches high with a 15 inch face, with side frames filled in with strips of ¾ by ¼ inch maple. A foot rest is provided under each seat, and a steel panel supports each seat on the step side of the car. On the closed side the seats are supported from cast-iron brackets on the posts.

The Stirling brake is used on one end of the car only. The lighting consists of a centre 5-light cluster and a 4-light cluster at each end, one light in the rear vestibule and one for the head light.

Messrs. Clarke Bros., of New York, and Thomas Meaney, of Toronto, are about to develop a water power on the St. Marguerite river, seven miles from the village of Seven Islands, in the province of Quebec. It is the intention to build a large pulp mill and to employ electricity for the operation of certain machines and a short railway. The company has agreed to expend $500,000 within two years. Henry Holgate, of Toronto, is consulting engineer for the hydraulic work.

Satisfactory progress is being made with the building of the plant of the Cascade Water, Power & Light Company, Limited, situated on the main Kettle river at Cascade, B.C. A dam has been constructed at the head of a rocky gorge, which raises the water to a height of 36 feet above the natural level, and gives a working head of 156 feet at low water. The dam is of timber crib-work filled with rock and 400 feet in length. The water is conveyed from the dam to the power house first by an open rock cut 225 feet long, then by a tunnel 400 feet and again by another open channel for a distance of 500 feet. The power house will be placed on at natural bay a the foot of the falls. The turbines will be of the horizontal type, two wheels in each case, and the generators, supplied by the Westinghouse Company, will be three-phase alternating type, while step-up transformers will be used to raise the current for transmission.

DEVELOPMENT OF ARC LAMPS.

The history of the arc lamp has been a story of improvement, and the tendency in construction has of late taken a decided turn toward the use of the fewest parts possible consistent with reliable operation. The result of this has been the production of arc lamps that are models of simplicity in mechanical construction and electrical design. For many years after the advent of commercial arc lighting the manufacturing companies, while exercising any amount of effort and skill in the perfection of generating apparatus, seemed strangely oblivious to the shortcomings of arc lamps. Any combination of magnets, levers, wheels and springs that would separate the carbons and feed them together again with any degree of regularity, was considered as fulfilling all requirements for an arc lamp.



FIG. 1
ALTERNATING CURRENT CONSTANT-POTENTIAL ENCLOSED ARC LAMP.

Recently, however, many important improvements have been made to this much neglected piece of apparatus. After a ssries of exhaustive experiments and tests, a constant direct series enclosed arc lamp has been evolved by the Adams-Bagnall Electric Co., of Cleveland, Ohio, which is a model of simplicity of design and excellence of construction, and which appears to fulfill every requirement of modern arc lighting. One of the most vital parts of an arc lamp is its cut-out. The Adams-Bagnall have produced a construction that is unique and effective and one which actually improves the more it is used. It consists of a bar loosely pivoted in its center to the upper end of the armature of the regulating magnet. One end of this bar carries the contact, which is of coin silver; the other end is shaped to form a contact of large service for carrying the volume of current. In operating, these silver contacts meet first and cut out the lamp, when by the combination of the motion of the armature, due to gravity, the finished brass surfaces are brought into contact for carrying the greater part of the current. As the silver contacts close first and open last, the sparking is entirely confined to their surfaces; the brass surfaces do not corrode by the action of the lamp. This is only one of the many improvements which have been made to the ordinary arc lamp, and the successes which it may be expected to attain in the future is attested by the fact that the Ottawa Electric Company installed last year 600 lamps of this pattern; and in the city of London, Ont., 350 are now in operation. This firm manufacture twelve varieties of arc lamps, including alternating current, constant potential, enclosed arc lamps as well as direct current, constant potential, enclosed arc lamps.

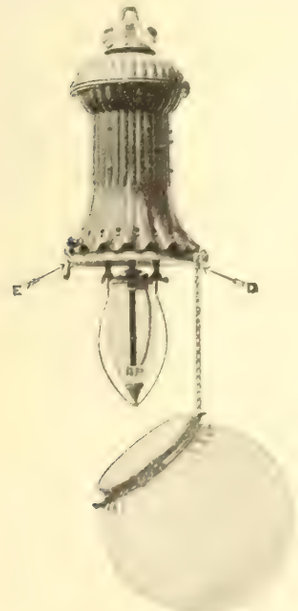


FIG. 2
SHOWING OUTER GLOBE RAISED FOR TRIMMING.



FIG. 3
SHOWING LAMP CASE OPEN FOR ADJUSTMENT.

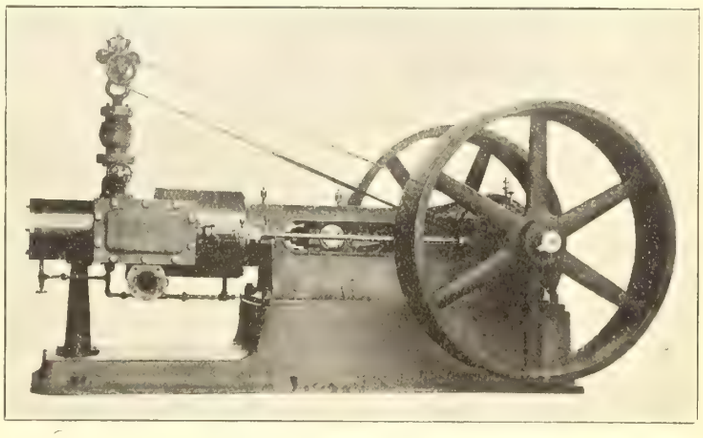
THE HARDILL COMPOUND ENGINE.

The town of Mitchell, Ontario, presents an example of Canadian enterprise in the possession of a company who are meeting with success in the manufacture of a compound steam engine invented and perfected by purely Canadian genius.

Mr. Joseph Hardill succeeded in January, 1899, in obtaining the Canadian and United States patents on a new design of cylinders and valves for a compound engine which had occupied his attention for a number of years. Considerable interest was hereby manifested among experts, who recognized in this design the possibilites of an inexpensive, yet complete and serviceable engine presenting promise of increased economy, besides other features heretofore unobtainable, at a price which would be within the reach of all steam users, and at the same time be so free from all complicated parts and gears that it could be operated by anyone capable of handling an ordinary slide valve engine.

An engine was accordingly built and sent to McGill University, where it was subjected to an unusually thorough and practical test, and although the engine was the first of its kind, the results, we understand, were gratifying beyond the fondest expectations of its builders, who were congratulated on their possession of a most valuable invention.

A company was then formed and incorporated under the name of the Hardill Compound Engine Company, of Mitchell, Ont., Limited, who immediately made preparations for placing the engine on the market, and have been working quietly for a little more than two years, perfecting designs and building patterns, so that to-day, as all who attended this year's Exhibition at Toronto will agree, they have succeeded in producing an engine



THE HARDILL COMPOUND ENGINE.

which for performance and appearance is of exceptional merit.

In the meantime a number of engines had been sold, and may be found doing almost every conceivable kind of work, and giving such general satisfaction that the success of this engine seems assured. The company are now prepared to supply this engine in all sizes, from 15 h. p. to 100 h. p., with the assurance that every engine will fulfill the claims made for it.

A company has recently been organized in Buffalo who are building the same engine and meeting with the same degree of success. One of their engines was tested at Cornell University, and its performance was such as to call for the most flattering commendations. It is hardly necessary to state that these two universities are equipped with special facilities for making such tests in a most thorough and vigorous manner, and that their reports are comprehensive and absolutely impartial.

The Hardill compound, of which an illustration is shown, is a compact, self-contained, medium speed engine of the tandem compound type. It may be operated as a double-acting or single-acting compound as may be required. The peculiar feature is the two-valve chests, one on each side of the cylinders. These chests form the bulkhead and are cast in the same piece with the cylinders, giving great rigidity to the structure. Each valve is complete in itself and independent of the other, being operated by separate eccentrics so that either may be shut off at discretion without impairing the operation of the engine, in cases where half or less than half the usual power is required. The valves are extremely simple and compact, and themselves form the means of conveying steam from the high pressure cylinder to the low pressure cylinder without the aid of a receiver or any other connections. This is in itself a strong recommendation, in addition to the fact that the steam from the high-pressure cylinder, before being admitted to the low-pressure cylinder, must pass through the valve which is at all times surrounded by live steam, thus preventing condensation and insuring the desired result of greater economy.

The makers are desirous of having the public become acquainted with this new engine, and will gladly correspond with all who are interested in a reliable and economical engine at a reasonable cost.

ENGINEERING and MECHANICS

OILING CRANK PINS, WRIST PINS AND GUIDES OF STEAM ENGINES.

By W. H. Wakeman.

The plan of oiling a bearing that is in motion (like the crank pin of an engine) from a stationary oil cup, is now so commonly practised that it attracts little or no attention among engineers in large cities. But this was not always so; even now there are hundreds of engines running without this great improvement, and there are still a few engineers who do not appreciate the value of such a device. The word "few" here means several thousands, for it is used in a comparative sense only; the total number of engineers in this country is very large.

From the time that I first opened the throttle valve of an engine until the present day, it has been my ambition to keep my engine running at full speed for the required number of hours, whatever that might be, from the mill that runs but five hours without a stop to a run of 132 hours without closing the throttle valve. During the first six years of this time I did not have any way of oiling my crank pin while in motion, except a cup that revolved with the crank. I am free to admit that the care necessary to keep that pin from heating was greater than that caused by all the other bearings combined, for I could fix them while running, but any mistake in setting that crank pin oiler was sure to bring the whole mill to a standstill before the appointed time.

The oiler consisted of a common brass cup screwed into the strap on the connecting rod, with a tube in the center through which a piece of lamp wicking was drawn. When this was new it would feed too fast; when it had been used a few weeks it fed just right, and after that it fed too slowly, provided it was not taken care of, so that the adjustment consisted in manipulating this piece of wicking every morning and noon so as to overcome its exasperating tendency to feed too much or too little; but the rule followed was made up from day to day, so that it is impossible to repeat it here.

On the second engine that I engaged to run, a very similar device was used for the crank pin. I soon discovered that this shop contained machinery that could not be stopped at pleasure without damaging the stock used, hence the crank pin became more important than ever in my estimation. I decided that a "wiper" was necessary, but wipers were expensive at that time, and as I was anxious to make as good a record as possible in the cost of running the plant, I had one made. A neighboring blacksmith forged out a piece of iron and punched a large hole in it, so that by taking one of the capscrews out of the main bearing, putting it through this hole and returning

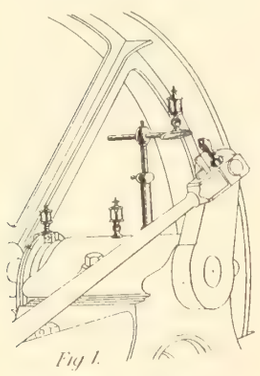


Fig. 1.

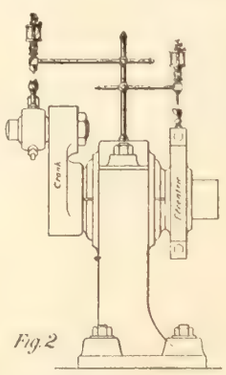


Fig. 2.

capscrew to its place, I had a standard that answered the same purpose as that shown in Fig. 1. A piece of sheet brass was fitted into the cup on the strap, a sightfeed oiler put on the standard, and other details attended to that made it possible to run that engine as many hours as required without shutting down to oil the crank pin. I am not advocating the idea of making such devices to the exclusion of those put on the market by reliable parties, for the ones sold in competition with others in the open market are nearly always better than any "home-made" device. As a rule they are cheaper, too, all things considered. I am not in sympathy with the man who uses $6.00 worth of time and $1.50 worth of stock in making an article he could buy for $5.00, and then boasts of his business sagacity. I do claim, however, that where an engineer can not induce his employer to purchase some needed appliance, he is justified in making it, provided it is not patented.

The wiper shown in Fig. 1 has a piece of flat lamp wick stretched in a horizontal position underneath the sight-feed oiler; as the oil is dropped on this it filters through and is wiped off from the under side by the moving cup. Fig. 2 is all metal, the oil falling through a slot and hanging underneath until the wiper comes around and takes it off. This illustration shows the same device in use on the eccentric engine. While this is not absolutely necessary on a slow-speed engine, it is a very good thing to have in use.

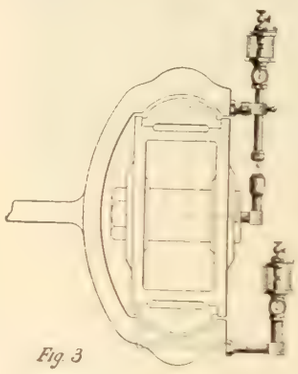


Fig. 3

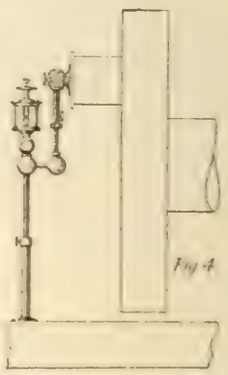


Fig. 4

Fig. 3 shows a wrist pin oiled in the same way, also a cup that feeds oil to the lower guide. The dotted lines show how the oil rises to both edges of this circular guide, thus insuring lubrication for the highest parts of it, after which the oil is sure to work downward to the lower part without further attention. Fig. 4 illustrates another device for oiling a crank pin while in motion. The principle on which it operates is the use of centrifugal force. The sight-feed oiler drops oil into the hollow ball beneath it, out of which it flows to the right and drops into the hollow ball which revolves opposite the center of the crank shaft. So long as it remains at the center there is no tendency to go in either direction, but when the crank is down the oil moves away from the center, and once started on its journey it quickly travels toward the crank pin without regard to the position of the crank. It is quite a job to apply this form of oiler to an engine in a mill, as two holes must be bored in the crank pin, but it is very satisfactory in practice, because it throws the oil less than any other device. The same principle is utilized on some center-crank engines, where oil is taken from oilers on the shaft bearings, and used in the same way.

Having described these oilers, I wish to call attention to their great value to steam users, not only on account of preventing lost time in shutting down during working hours, but because they deliver oil to the rubbing surfaces in small quantities and at regular intervals. It is quite possible for these surfaces to wear much more than is necessary without heating or giving any outward indication except that the keys need frequent adjustment and the boxes are worn out sooner than they ought to be. Some mill owners regard such devices as luxuries, therefore they can be dispensed with; but this idea is not wholly correct, for while a mill can be run without them it does not pay to do it. It seems rather inconsistent to find a mill in a city, near machine shops and other places where repairs are made, fully equipped with oilers that prevent friction and wear, and then to find another mill located several miles from the nearest machine shop (which may be a primitive affair at best) fitted with oilers that do not prevent the bearings from becoming warm every day. In such places repairs are always expensive, since it takes so long for one or more machinists to reach the place.

The only objection to wipers on the crank pin and wrist pin of an engine is that they call for oil cups, or rather oil-catchers, that are open on the top, and when located in a dusty mill there is a chance for some of the flying dust to get into the open cups and clog them, or work down into the bearings and damage them. This objection may easily be overcome, how-

ever. A small piece of waste put loosely into each one will allow the oil to filter through it, but will catch the particles of dust. It is necessary to renew these pieces of waste frequently in order to prevent them from becoming hard enough to stop the oil from filtering through fast enough to keep the bearings well lubricated. This is but a small job, and need not be done more than twice each week.—The Wood Worker.

CANADIAN ASSOCIATION OF STATIONARY ENGINEERS.

HAMILTON NO. 2.

THE first open meeting of Hamilton No. 2 took place on the evening of October 10th, when a paper on "The Metric System of Weights and Measures" was read by Mr. J. Gill, B.A., of the Collegiate Institute, Hamilton. The paper was very interesting, and the Association is to be commended on being the first to take up this subject.

TORONTO NO. 1.

Editor ELECTRICAL NEWS:

Dear Sir,—At a meeting of the above Association held on Wednesday, September 15th, I was appointed correspondent to the Mechanical Press. We had a fairly good meeting; several questions being up for discussion, one regarding the respective merits of the Wheelock, Corliss and Brown engines. Each engine had its supporters, and from the points brought out it would be difficult to say which engine is the best.

At a meeting on October 2nd the Educational Committee reported that it was the intention to hold a series of open meetings on the third Wednesday of each month during the winter. The first will be held on October 16th, when a paper will be given by Bro. W. Bourne, superintendent of the Toronto Electric Light Company, on "Care and Management of Dynamos and Motors." A cordial invitation is extended to all who are interested in electrical engineering. Trusting that you will find space for this in your valuable paper, I am,

Yours truly,

H. E. TERRY,

Corresponding Secretary.

MONTREAL

Branch office of the CANADIAN ELECTRICAL NEWS,
Imperial Building,

MONTREAL, OCTOBER 5th, 1901.

Although business has been rather quiet electrically during the hot summer months, when there was a considerable exodus from Montreal, it has now resumed its sway, and the outlook for the fall is very fair.

There seems to be little doubt but that the St. Lawrence Power Company, who tendered for the civic arc lighting in Montreal, (but lost it through no fault of their own), mean to do business in this city any way. The names they mention in their directorate ought to get them right of way via C. P. R. track land to Montreal, with the fair chance of doing some business at small villages along the route. Apart from arc lighting there is still a good field for them for motor and residential incandescent power.

Both the American and International Schools of Correspondence, each of which conduct electrical courses, have opened local offices in the vicinity of the corner of Windsor and St. Catherine streets.

The new distributing station for the Royal Electric Company is now pretty well built, and when completed will give them more scope to handle additional load. We understand the layout of this is in the hands of Mr. Marchand, formerly expert with the Westinghouse Company, but now employed by the Chambly-Royal combination.

It would be interesting to know, in the face of the elaborate systems for handling accounts described at one of the late C. E. A. conventions, why the Montreal Gas Company is able to handle a greater number of accounts than the Electric Company, and with less staff?

The Bell Telephone Company deserve great credit for one of the finest telephonic equipments ever produced and installed. We refer to the system they have lately put up in the Royal travelling train.

Some of the illumination devices for the royal visit were certainly worth comment. Referring to those on Windsor Hotel, which designs, we read in the lay press, were imported from England: Since when was it necessary to import from England the "stars and stripes," and why use it at all? It may be a desire to please American guests, but if so it was a very poor compliment, to say the least, to the city's Royal guest. There was no harm in Americans so honoring our prince, but Britishers surely can honor him by other means than by display of a foreign flag, even admitting the fact that it was a nice combination of colored electric bulbs. Another anomaly was the (so-called) Irish flag, consisting of the Union Jack in the left upper corner, green ground with yellow harp. Prettily lamped, we admit, but such incorrectness and lack of taste ought to cause our future king to smile if nothing more. This design surely was not "imported."

The Grand Trunk Railway depot was a neat bit of work, the illumination installation being done by the Royal Electric Company. This company installed thousands and thousands of incandescent lamps on many public buildings, principally "strip work," picking out the architectural beauties of the different buildings with good effect. Clear lamps were almost invariably used. Among the monograms, shields and like devices shewn, the Montreal Electric Company had some handsome combinations; the backgrounds being all neatly painted or gilded in "proper" colors and picked out with colored lamps to match. Columns might be written on the illumination question, but suffice it to say that every electric contractor and power supply company in Montreal was rushed. On the average good taste was displayed by the contractors with their designs, and it is safe to say the two evenings will be referred to by electricians here in days to come when the Duke is safely back in his own home.

According to the lay press, Tesla is again "promising things." Is it not nearly time for some one to sue that gentleman for "breach of promise"!

The Canadian Pacific Railway was patriotic enough to manufacture the cars for the Royal train in Canada; yet gave the illumination of their building for the Royal visit to an American (Boston) firm. "Shades of Sir John—what is patriotism?"—evidently dollars and cents.

Another municipality wants to try it. As Westmount (Montreal) got no answers to their request for tenders for municipal arc lighting, owing to the fact that the companies were then busy flying for bigger game, they now think they would like to emulate some Ontario towns by having their own plant. The success of such in the face of statistics is exceedingly doubtful, but as the suburb in question is apparently honestly governed, it is just possible they might succeed.

Here is an instance of charges for current during the visit of His Royal Highness the Duke of York. Minimum charge would be $50 for 100 lamps for the two evening's display. Let us compare this with meter ordinary rates: Say 4 hours per night = 400 lighting hours per night, or 800 lighting hours per two nights × ¾ cent per lamp hour = $6.00 less 33⅓% discount = $4.00 net. Rather a difference! Now, multiplying the regular rate by 12½ times, is good figures, and at such prices patriotism comes high. Although the public were prepared to pay higher than usual, there were many who deemed this extortion, and who promise to remember the fact when the proper time comes.

A New York newspaper correspondent writes his paper to the effect that Quebec had the site, but Montreal had the money, hence the illuminations were grander. So say all of us who have seen both, and it is exceedingly doubtful if any other city will have 40,000 additional lights going for His Royal Highness.

The public who use incandescent light in their homes are beginning to wonder whether they may not pay dearly for the late civic arrangement with the Royal Company of $60.00 per arc. It seems the fact of putting a maximum rate for private incandescent, which appeared in old arrangement, has been overlooked in the new, and the Royal's incandescent rate at present is ¾ cent per lamp hour on 50 volt basis, less 33⅓% cash discount for prompt payment. The Lachine Company are on the same basis except that their discount is 40%. The old rate was ¾c. net.

Mr. Walbank, the able and energetic managing-director for the Lachine Rapids Company, is to be congratulated on again securing the arc lighting contract for the municipality of Westmount. The figure named is $90.00 per arc per annum. This is slightly better than the former price to the municipality, which was $100.

Mr. Tabener, one of the most esteemed contract canvassers, formerly with the Royal Electric Company, has severed his connection with that company, and accepted a like position with the Lachine Company. His friends will wish him success in his new position.

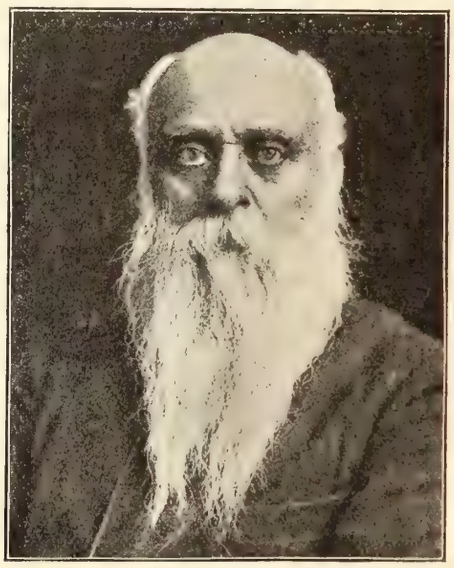
The Standard Light & Power Company, which is to a certain extent affiliated with the Lachine Company, has just declared a dividend at the rate of 8 per cent. per annum. This company is managed by Mr. Chas Morton, and appears to move in the even tenor of its way, doing a snug and profitable little business and keeping free from fracas with civic officials and costumers. They purchase their "juice" wholesale, as it were, from Lachine Company and transform it by motors and dynamos from A. C. to D. C., serving principally motors; although they do considerable lighting also. A steam reserve plant is kept as a stand bye.

The Imperial Electrical Company in the north-eastern part of the city, have transferred their allegiance (or are about to do so) to the Royal Electric Company. This company do considerable lighting business in that portion of the city, and have a numerous clientele of retail stores on St. Lawrence Main street.

MR. JOHN HORN.

It is with peculiar satisfaction that we reproduce herewith the portrait of Mr. John Horn, a well-known telegrapher of the early days. Mr. Horn was the editor of the first Canadian electrical journal. It was published in Montreal by Hart Bros. & Company, in the year 1884, and bore the same title as this journal, the publication of which was commenced some years after the pioneer electrical journal had ceased publication.

Born in Montreal in 1837, Mr. Horn at sixteen years of age found employment with the Montreal Telegraph Company, and in 1857 removed to New York, where he became identified with the American Telegraph Company. Afterwards he entered the service of the Western Union Telegraph Company and for a time was manager of the stock exchange business of that company.



Mr. John Horn.

Returning to Canada he engaged in the Canadian Military Telegraph Service in the North-West. In late years Mr. Horn has been a resident of Montreal. He is the possessor of a fine collection of early American and Canadian history of the telegraph and of many relics relating to the early days of the discovery. Mr. Horn still takes an active interest in everything pertaining to the application of electricity and was a prominent figure at the recent convention in Montreal of the Old-Time Telegraphers' Association.

ELECTRICAL DEVELOPMENT IN TORONTO.

The rapid growth of business in the supply of current for both light and power has compelled the Toronto Electric Light Company to install another new engine of 1,500 horse power, built by the Polson Company of Toronto. This engine, which is of the vertical type, has unusually heavy parts and is most substantially built throughout. The fly-wheel weighs 40 tons, the total weight of the engine being in the neighborhood of 200 tons. The cylinders are 56 inches in diameter. The bearings throughout are water-jacketted, thus insuring coolness in operation. This new engine is called the "Duke of York" and was put in operation on Thursday last on the occasion of the Duke's visit to Toronto.

The Toronto Electric Light Company have now a total engine capacity of 7,000 horse power, and owing to the rapid growth of their business will be compelled to install additional engines at an early date. About two-thirds of the engine capacity is in constant operation, one-third being always kept in reserve. On the occasion, however, of the Royal visit more than the total capacity was required to supply current for street illumination.

THE USE OF FRICTION CLUTCHES.

The Dodge Manufacturing Company, Toronto, have drawn our attention to a paper on friction clutches read before the New England Manufacturers' Association by Mr. R. Hill, of which the following is an abstract :

To construct a good efficient friction clutch of any class requires a great deal of patience of the cut and try order until the parts are so constructed and balanced that the clutch will back up the principle involved and when put on the market it will not be a source of annoyance on account of the weakness of some apparently unimportant part. I would advise that when you get your clutch, be sure it is fitted by a careful and exact machinist who is well acquainted with the clutch in hand. Provide solid, substantial foundations, and in the case of large friction cut-off clutches use a connecting bed plate for the bearings on each side of it, and when it is erected, be sure the shafts are in perfect alignment and that they will be held there.

The growth of the friction clutch industry has, like many other good things, been phenomenal. It is my firm belief that there has been manufactured and put upon the market a larger value and greater number of friction clutches in a single day in the year 1900 than was produced in the whole year of 1875. The general introduction and use of electricity has been largely responsible for the increased demand for first-class friction clutches. The high speeds at which they are invariably run in electrical generating plants, and the extremely severe duty required of them for this class of work, has brought out the best efforts of our mechanics in producing satisfactory running clutches. It has been one of the best advertising mediums of the friction clutch business, and has, in many instances, shown to enquiring minds the advantage of the adoption of friction clutches in other channels of work.

It is an accepted fact that no first-class builder of machine tools, or of any other machines that need to be stopped and started frequently, does not find it to his advantage, as well as to his customer's, to use friction clutches to operate the said tools or machinery. Compare the ordinary engine lathe, built on modern lines, having a good friction clutch pulley countershaft, with that old annoying arrangement having a jaw-clutch pulley countershaft. The slam-bang noise of one of these pests when in use in a shop is enough to put the men's nerves on edge, to say nothing of the hard labor and skill necessary to operate it and the liability of spoiling the work in hand.

Go a step further and compare the modern friction clutch pulley countershaft with the old tight and loose pulley affair with its shifting, sluggish, squealing belt, which is continually wearing out and breaking down. Note the ease with which the operator controls the machine having the friction clutch device. He can do more work, better work, with less exertion and less wear and tear on the machine and belts. Yet it is not such a long time since the manufacturer, and even the operator, thought the old jaw-clutch or tight and loose pulley device on a lathe was pretty good. The fact is, they did not know of anything better. It is human nature to judge by comparisons, and the enlightenment in the use of friction clutch devices, their advantages on a lathe counter or any other machine, is the reason of the ever-increasing demand for the many thousands of friction clutches manufactured annually and the enormous increase in the number of willing buyers.

SPARKS.

The village council of Hintonburg is considering municipal ownership of electric lighting. It is estimated that, with the boiler and other appliances which may be utilized, a plant could be installed for $4,000.

The Canadian Niagara Power Company have taken tenders for placing cofferdam in the Niagara river and for laying an underground conduit to the extent of 36 ducts for one mile. The work is in charge of Mr. Cecil B. Smith, Ma. E.

John Blackburn, an electrician, died in the General Hospital in Toronto last month, from injuries received in a fall from a telegraph pole in Wheeling, West Virginia. The fall was caused by his arm coming in contact with a live wire.

M. N. Patrick, Industrial Agent Seaboard Air Line Railway at Pinehurst, N.C., the well known winter health resort offers building sites, power, etc. to parties wishing to start manufacturing in a small way with view of enlarging. No doubt many will accept this generous offer.

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Alternating Current Enclosed Arc Lamp.
Constant Potential Series Enclosed Arc Lamps to operate five in series on 500 Volts with one external rheostat for group of five lamps.
Constant Potential Series Enclosed Arc Lamps to operate two in series on 220 Volts, with one external rheostat for two lamps, (External rheostat).
External Rheostat for constant Potential Series enclosed Arc Lamps, two in series on 220 V.
External Rheostat for constant Potential Enclosed Arc Lamps, one series 220 Volts.
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EQUIPMENT OF THE ROYAL TRAIN.

The special train provided by the Canadian Pacific Railway for the transcontinental tour of the Duke of York is equipped with very many conveniences and luxuries which are not usually found in the ordinary passenger train.

The train was divided into two sections, the second containing the Royal party being equipped with electric light and telephones. The electric lighting equipments were furnished by the Gould Coupler Company, of New York, and consist of an axle-driven dynamo for charging the storage battery and a battery for lighting the car. There is one of these complete equipments of double the necessary capacity under each car. The total number of 8 c. p. lamps on the train is 435, the coaches averaging 60 each and the two baggage cars 10 each. In addition there is an engine and dynamo equipment in the baggage car, taking steam from the locomotive as a spare should anything go wrong with the axle equipments. This auxilary equipment is hardly necessary, as the train is so interconnected that any car can light any other from its batteries or charge the batteries of the disabled car from its dydamo.

The capacity of the batteries uuder each car is 600 ampere hours, with a discharge rate of 100 amperes, and the voltage used is 25, so as to cut down the number of cells required, and also to admit of the use of 2.5 watt lamps, which are possible on the low voltage. The operation of the equipment is as follows :

When the train attains a speed of say twenty miles, a flyball govenor switches the dynamo which has acquired the proper voltage on to the one section of the battery which it charges, while the other equal section of the battery lights the car.

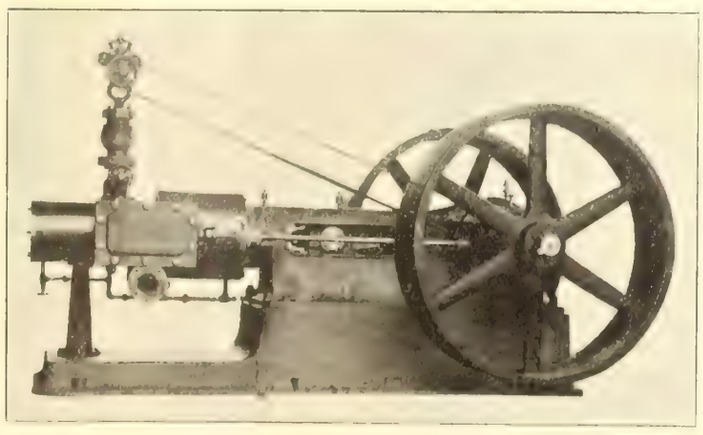
As the speed of the train increases the dynamo voltage would also rise were it not that the machine is hung in such a way that the increased current on the battery requires more horse power than the belt will stand without slipping, which it proceeds to do, thus keeping the dynamo speed and consequently the voltage within the limits allowed for battery charging. This dependence upon a slippery belt for voltage regulation appears to be the height of foolishness, but the results of the operation of this system on a number of other cars of the company have been very satisfactory. The lamps for train lighting are frosted or iced glass of candle or the usual pearshaped pattern, mounted in candelabra and other artistic fittings on the walls and in movable stands on tables where required.

There is also a telephone system connecting the cars of the train together, allowing intercommunication between all of them. The sets were specially designed for this train, and the cases are the same wood and finish as the interior of the cars in which they are placed, one being of oak, one of prima vera and the rest of mahogany. Eight sets are provided, one for each car, each one being placed in a convenient but not obtrusive location. The cases are about 6 inches by 10 inches, the faces being equipped with a number of sockets, each one marked with the name of one of the other cars. A plug which fits them is attached by means of a flexible cord to the side of the box, while a push button is located above the socket, with a vibrating bell on the top of all. To communicate with any car the plug is inserted in the socket marked with name of car wanted, and the button is depressed when a signal is sent in, power being derived from a battery of dry cells about the middle of the train.

For talking, special combination telephones and transmitters are provided. If a transmitter were attached to the car in any way, the vibration of the train would disturb the transmitter, causing such a noise in the telephone as to make conversation next to impossible. These combination sets are arranged so that when the telephone is taken from the hook, the transmitter, being joined to it, is also removed. When the telephone is held to the ear, the transmitter mouthpiece, which is curved, is at a convenient distance from the lips. By removing the transmitter from all connection with the body of the car the noise due to vibration is reduced to a minimum and talking is good.

The cars are wired with rubber covered wire cable run underneath the car. Under each platform is a brass case in which are placed insulated brackets or "jacks," one for each line. To connect the cars, flexible cable or rubber covered wire is provided, with a case of plugs at each end (the plugs being insulated from the case), which fits the case of sockets under the ears. The two cases of plugs are also connected by a chain, so that if the cars should break apart, the plugs would be pulled out of the sockets without damaging the connecting cable.

The sets are made by the Northern Electric & Mfg. Company, of Montreal, and the installation was done by the Bell Telephone Compauy of Canada.



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Universal Application

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THE HARDILL COMPOUND ENGINE CO.,
OF MITCHELL, ONT., LIMITED

The annual meeting of the Standard Light & Power Company of Montreal, was held last week. The annual report submitted showed that the gross revenue had been $51,472.26, and the net profit to date $26,268.64. The retiring Board was unanimously re-elected, and at a subsequent meeting of the Board Mr. W. McLea Walbank was elected president and managing-director, Mr. J. H. Burland vice-president, and Mr. E. Craig secretary

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* * *

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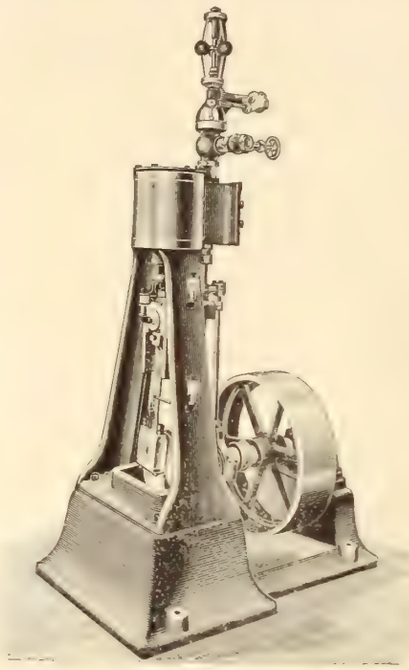
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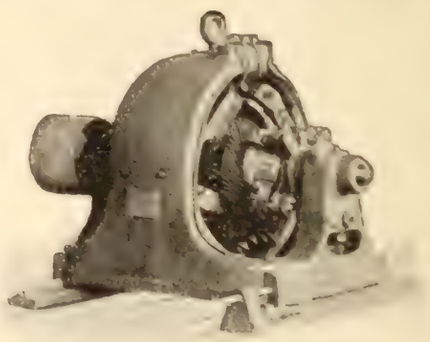
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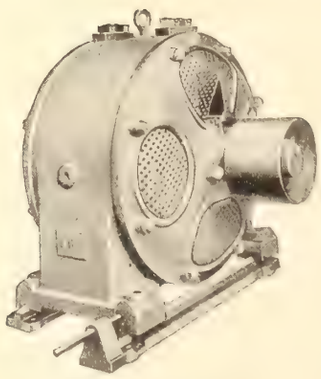
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STREET CAR FENDERS.

The agitation for an efficient fender on street cars has resulted in the passing of an order in council approving of three inventions for use on the street cars in Ontario. Those to which the provincial engineers gives his official approval are the Providence fender, the Twentieth Century fender, and the improved Sleeman fender. In his report the engineer says: "I have examined all the drawings, models and full-size designs of street car fenders submitted to me, and, where possible, I have submitted such designs to practical tests. These examinations and tests have demonstrated to my satisfaction the superiority of the Providence, Twentieth Century and improved Sleeman fenders over any other fenders I have seen, and their suitably for use by electric railway companies, having regard to efficiency for life-saving purposes and the other considerations mentioned in the said act. I therefore beg to recommend the adoption of one or more of these fenders by the street railway companies of the Province." Street railway companies will now be called upon to equip their cars with one of the above named fenders, but exception will be made in the case of companies which have existing agreements with the municipality as to the use of any particular fender.

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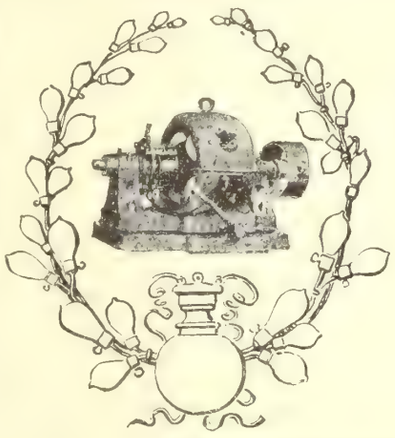
RECENT PLANTS INSTALLED: Lachine Rapids Hydraulic & Land Co., Montreal, Que., 12,000 h.p.; Chambly Manufacturing Co., Montreal, Que., 20,000 h.p.; West Kootenay Power & Light Co., Rossland, B.C., 3,000 h.p.; Dolgeville Electric Light & Power Co., Dolgeville, N.Y.; Honk Falls Power Co., Ellenville, N.Y.; Hudson River Power Transmission Co., Mechanicsville, N.Y.; Quebec Railway, Light & Power Co., Quebec, 4,000 h.p.; The Ottawa Electric Co., Ottawa, Ont., 2,000 h.p.

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SPARKS.

Directors of the Sarnia Electric Railway Company, Sarnia, Ont., were last month elected as follows: President, J. D. Beatty; vice-president, James Flintoff; directors, Frank Smith, W. B. Collins, T. H. Smallman, MR. Kenzie, and R. Kenny. W. H. Mills is manager and secretary-treasurer.

The town of Rat Portage, Ont., passed a by-law reducing the rates of the electric light company by 35 per cent. The company entered suit to upset the by-law, and on September 27th an injunction was granted by Mr. Justice Street, in Toronto, to restrain the town from putting the by-law in operation.

The civic officials of Ottawa have been getting some information as to the number of poles, wires, conduits, etc., in use by the various companies using the city streets. The Bell Telephone Company have within the limits 2,100 poles, 13,781 feet of conduit and 330 miles of wire. The value of the poles, wires and attachments is estimated at $28,200.91. The Great Northwestern Telegraph Company have 208 poles and 46 miles of wire, of a total value of $600. The Ottawa Electric Company have 3,361 poles, 7.160 miles of poles, and 375.57 miles of wire, of a total value of $76,983.87. The Ottawa Gas Company have 35 miles of gas mains, of an estimated value of $31,306. The value of building, plant and machinery is $50,680.

A demonstration of the efficiency of the electric fire-proofing process as applied by the Electric Fire-Proofing Company of Canada was witnessed on the Champ de Mars, Montreal, on September 11th. A house built entirely of wood treated by this process was tested by placing inside thereof a large amount of kindling and fire wood saturated with kerosene, which was then set on fire. The structure could not be made to burn and the experiment proved most successful. At the conclusion of the test the Mayor congratulated the company and stated that he hoped to see the day when wood proofed by the electrical process would be used in all constructions in Montreal.

The town council of Collingwood, Ont., recently invited tenders for the supply of new apparatus for the electric light plant. Tenders for the boiler were submitted by the Goldie & McCulloch Company, of Galt; Waterous Engine Company, of Brantford; Abell Engine Company, of Toronto; and J. Inglis & Sons, Toronto. The tender of the Waterous Company for a boiler 14 x 66, at $840, was accepted. The Canadian General Electric Company and the Westinghouse Company tendered on the dynamo, the former securing the contract at $2,300 for a single phase alternating machine with a capacity of 2,080 lights. J. Forman, of Montreal, and the Canadian General Electric Company tendered on the supply of wire, the latter getting the contract at 19½ cents per pound f.o.b. Peterborough.

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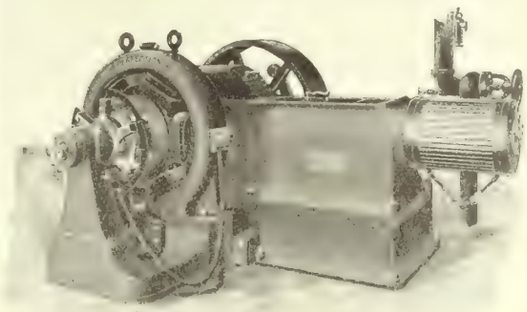
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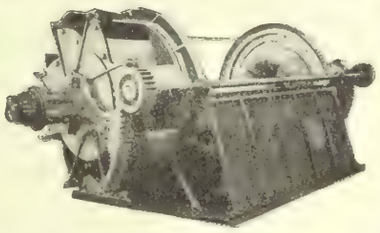
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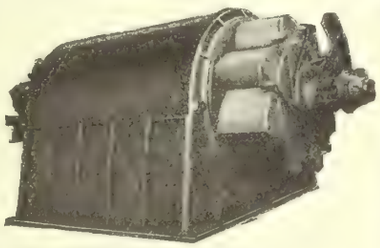


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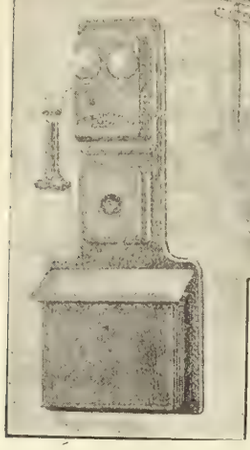
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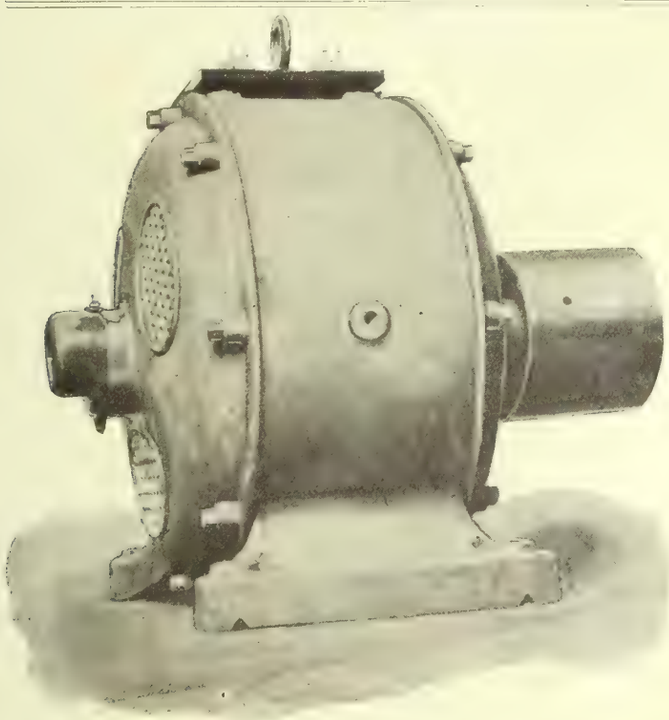
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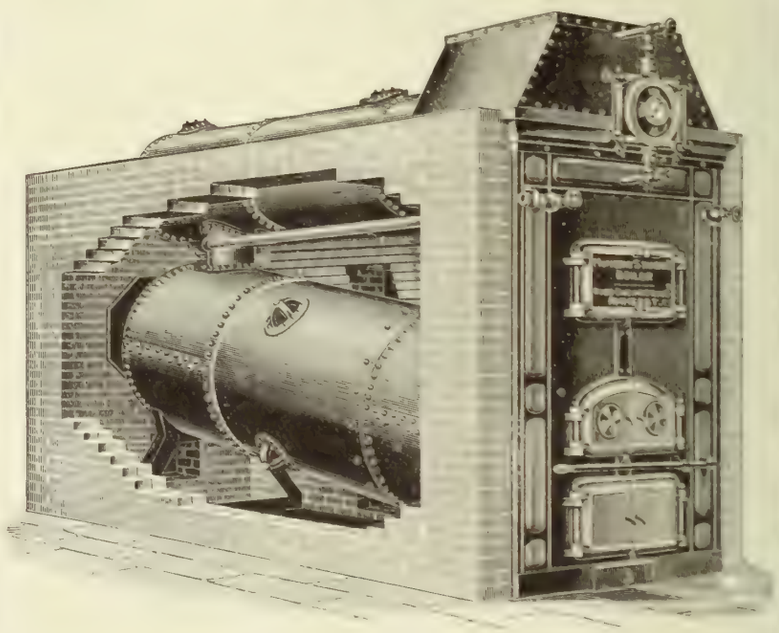
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The Charlottetown Electric Light & Power Company, of Charlottetown, P.E.I., have engaged the services of an expert to superintendent proposed improvements to their plant.

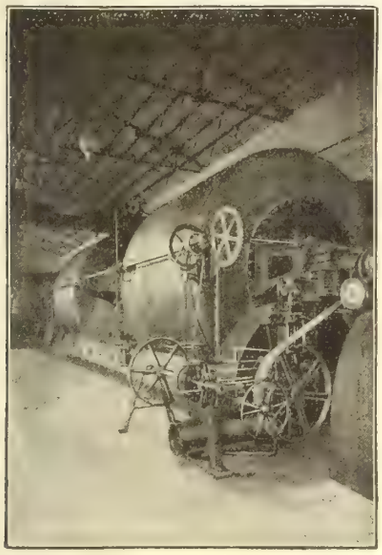
The street railway of Windsor, Ont., has been purchased by the Everett-Moore syndicate for $390,000. It is not expected that any changes will be made in the official staff.

Mr. M. W. Comstock, of Buffalo, representing the Chippewa & Niagara Falls Electric Railway Company, has asked permission to construct a line of railway along the streets of Niagara Falls, Ont.

John Starr, Son & Company, of Halifax, N.S., have secured an order for a complete lighting plant and marble switchboard for I. Matheson & Company, New Glasgow, N.S., and the Amherst Boot & Shoe Mfg. Company.

It is said that a deal has been consumated whereby the Quebec Railway Light & Power Company agrees to lease 1,000 horse power from the Canadian Electric Light Company, of Levis, and that the latter agree not to make an installation in the city of Quebec. The sum to be paid for the power is in the vicinity of $15,000.

The Robb Engineering Company, Limited, Amherst, N.S., are supplying a 75 h.p. Robb Armstrong compound engine for the Sackville Electric Light Company and a compound engine for the lighting plant at Grosse Isle quarantine station.



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WRITE FOR CATALOG. DEPARTMENT E.

SPARKS.

The electric light plant now being installed at the Grosse Isle Quarantine Station, by Ahearn & Soper, Limited, of Ottawa, consists of a 60 k.w. 7,200 alternations, 2,000 volt Westinghouse generator, operated by a Robb engine. About 1,000 incandescent lights will be placed in the various buildings on the Island and some 15 arc lights on the roadways.

It is estimated that the cost of steam power, owing to the use of the muntiple-cylinder engines, higher steam pressure, steam jacketing, etc., has decreased nearly 40 per cent. since 1870. With a corresponding, or even greater decrease in the cost of electrical power, the world's work will be done much more cheaply the coming century than it has been accomplished in the present, with results that will effect great social and industrial changes.

Mr. F. H. Clergue, of Sault Ste. Marie, is projecting another water power canal, having in view the development of 20,000 h.p. electrically from the rapids of the St. Mary's river. The St. Mary's Falls Power Company has been organized for the purpose. The plans contemplate the construction of two parallel dykes on the bed of the rapids. These dykes will each be 3,100 feet long. The fall of water is about 18 feet, and the bed of the rapids is of stone, thus affording a firm foundation for the dykes and building.

The contract for electric lighting in the city of St. Catharines has been awarded to the Lincoln Electric Light Company for a period of five years. The company will at once proceed to remodel the system and bring it up-to-date in every particular, so as to be in a position to furnish a first-class service for light and power. Negotiations are now in progress for the purchase of a 250 k.w. two-phase generator and other apparatus necessary to increase the output and efficiency of the station. The company have contracted to furnish to one manufacturing concern current to the amount of 300 h.p. They have also in hand orders for about 1,500 additional lights which could not be supplied under the conditions existing in the past. The outlook for the supply of both light and power is said to be a promising one. There are at present connected up about 6,000 lights and it is believed that this number can be largely increased. Mr. W. A. Martin, late of the Hamilton Electric Light & Power Company, has been appointed manager of the Lincoln Electric Light Company.

The Cornwall canal is now lighted by the new power plant of the St. Lawrence Power Company. There are 250 alternating enclosed arc lamps, the lights being 400 feet apart. A line of cedar poles, nicely trimmed and painted, follow the south bank of the canal. The lighting and power lines are supported by the same poles, which are set about 100 feet apart, every fourth pole supporting the lamp on the series system. Motors are provided for handling the sluice gates and for opening and closing the lock gates, as well as for the control of the weir gates, by which the levels of the different sections of the canal are regulated. The lights extend from Cornwall to Dickenson's Landing, a distance of 11 miles, the power house being located about midway between the two cases. Messrs. T. Pringle & Son, of Montreal, were the engineers for the entire work, Mr. F. H. Leonard, jr., E.E., having charge of the electrical installation. The electrical manchinery was to be supplied by an American firm, but owing to their inability to deliver it on time, an S.K.C. two-phase generator of 200 k.w. capacity was obtained from the Canadian General Electric Company.

TRADE NOTES.

The Windsor Plaster Company, of Windsor, N.S., have ordered a 100 horse power boiler and engine from the Robb Engineering Company, of Amherst.

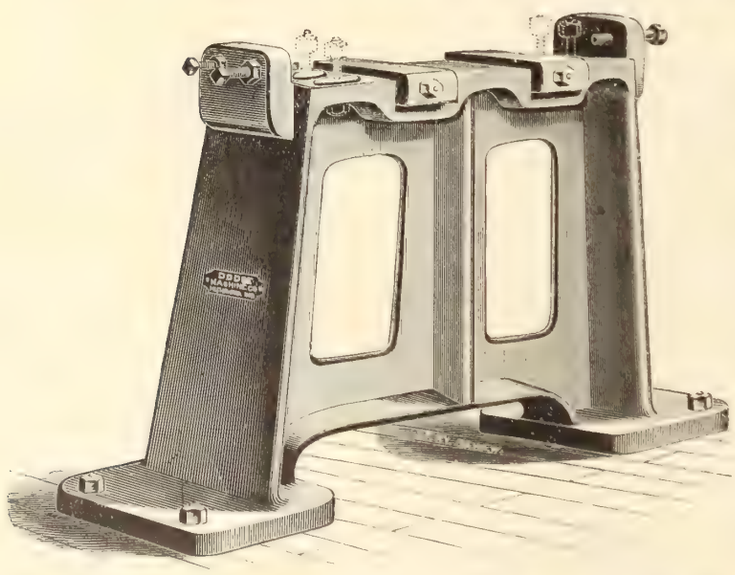
Teaching modern languages by mail is one of the courses of the International Correspondence Schools, of Scranton, Pa. This is accomplished by means of the phonograph.

The Robb Engineering Company, Amherst, N.S, has received an order, through Ahearn & Soper, Ottawa, for a 100 horse power engine for the Government quarantine station, Grosse Isle, Quebec.

The Chambers Electric Light & Power Company, Truro, N.S., are installing three Jones underfeed stokers. They recently added a 30 k.w. generator manufactured by the Canadian General Electric Company.

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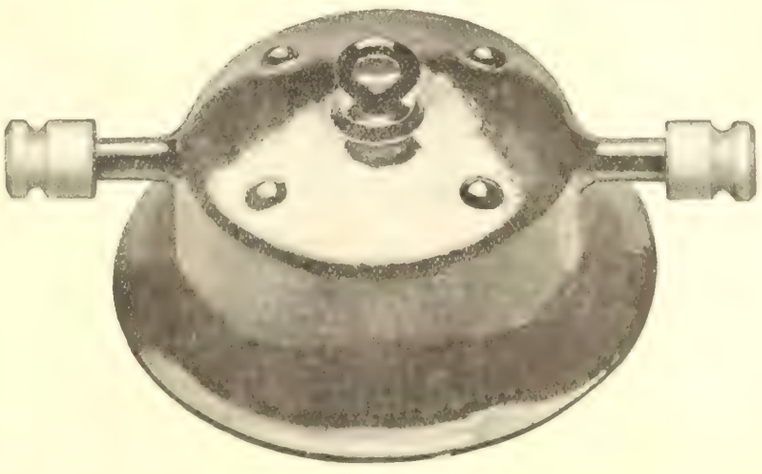
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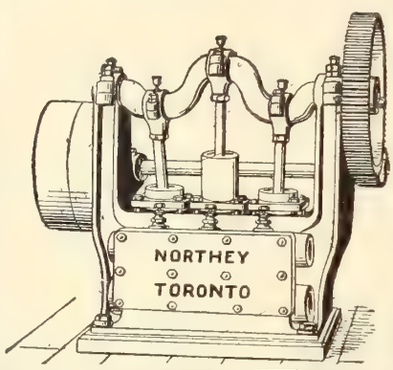
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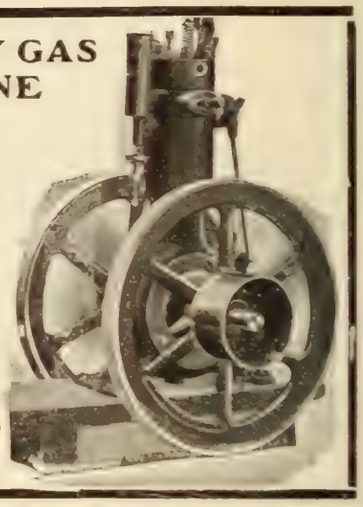
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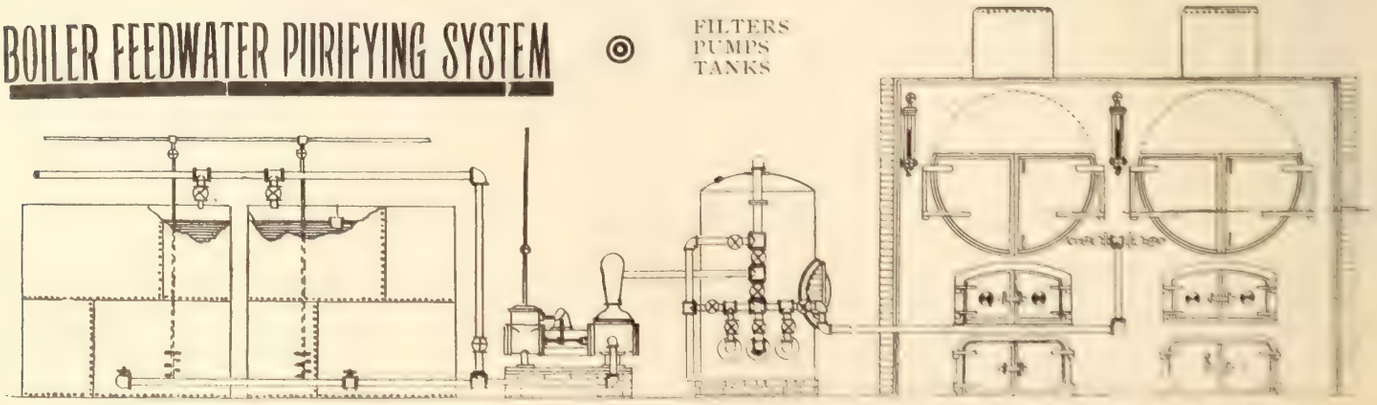
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ELECTRICAL NEWS

AND

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VOL. XI. NOVEMBER, 1901 No. 11.

NEW DISTRIBUTING STATION.

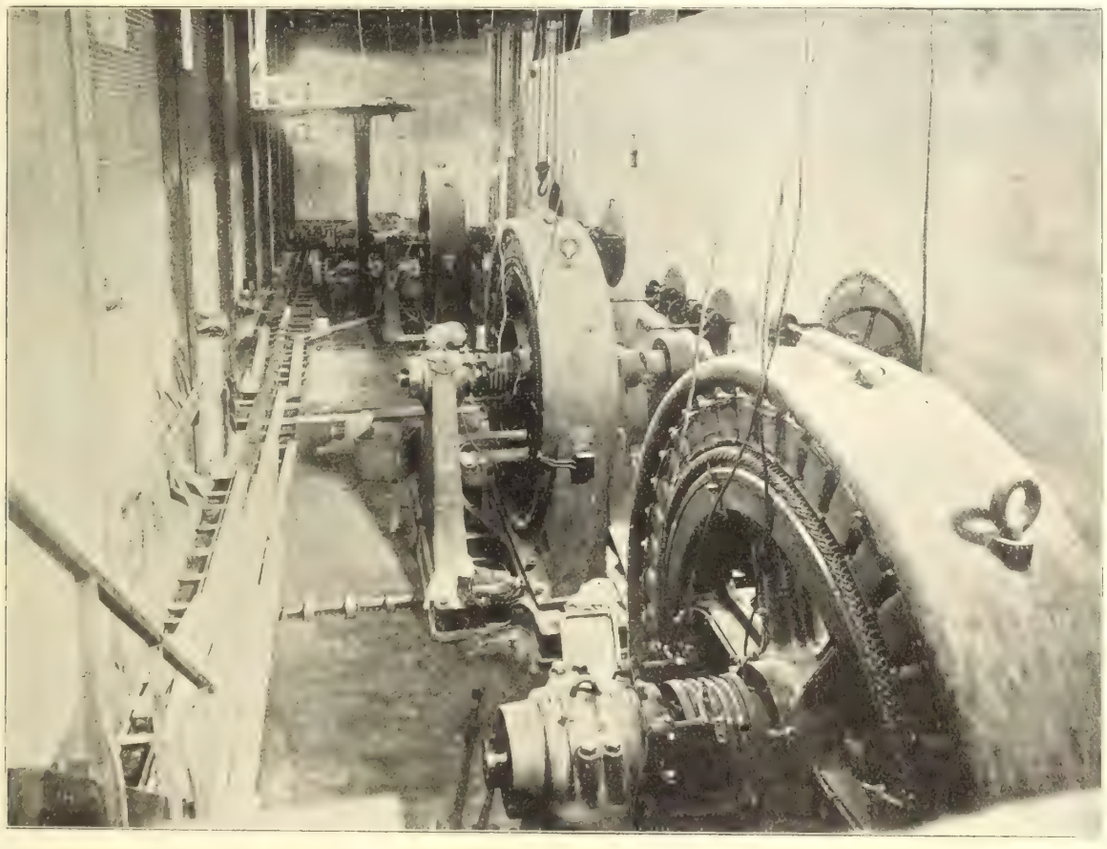
The new station of the Ottawa Electric Company, which has been under construction since shortly after the great fire of April 26th, 1900, was opened on Thursday, 24th ultimo. The water was let into the flumes at 9.30 in the morning, and at 9.54 one set of wheels and the first generator were started. The station is almost complete, there remaining only the switchboards and cables to install. The experiment was exceedingly satisfactory to all parties concerned, the concrete walls proving to hold water exceedingly well, there being practically no leakage anywhere. The whole work is of the most satisfactory character. Nothing enters into the construction of the flumes and buildings but iron, steel, stone, brick and concrete. They are absolutely fireproof, even the window frames and sashes being of metal.

The equipment consists of three 700 K-W., 2200 volts, two-phase generators, manufactured by the Westinghouse Company, and adapted to run at 180 r. p. m., giving 7,200 alternations per minute. These are directly connected each to three 39″ wheels attached to one shaft and governed by Lombard water wheel governors. The wheels were manufactured by the Stilwell-Bierce & Smith-Vaile Company, of Dayton, Ohio.

For the accommodation of the patrons of the company who already have D. C. motors, a rotary transformer and storage battery supply D. C. power.

The arc light plant consists of six Western Electric Company 150 light generators direct connected in pairs to three 250 h. p. Westinghouse induction motors. These supply current to Adams-Bagnall series D. C. enclosed arc lamps. There are two exciters direct connected, each capable of exciting all the generators in the station. These run at 475 r. p. m, and each is driven by a pair of 15-inch wheels. Provision has been made for the possible clogging of these wheels with frazil, by attaching driving pulleys to the shafts of the main wheels, to which the exciters may be belted while disconnected from the water wheels.

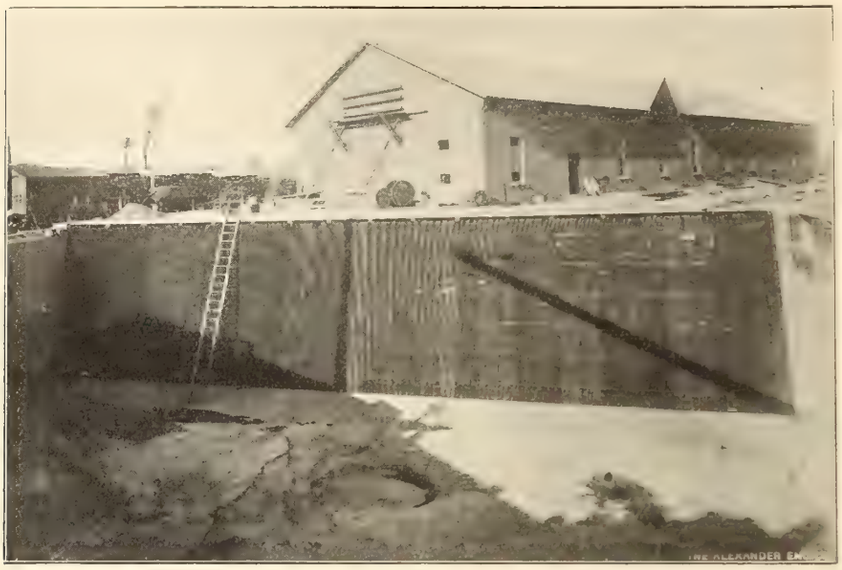
The switchboards will be very complete and modern in character, special attention having been given to this part of the work so as to ensure easy operation of the station. All connections will be made through



DISTRIBUTING STATION OTTAWA ELECTRIC COMPANY. VIEW OF DYNAMO ROOM FROM WEST END.

lead covered cables laid in troughs in the floor. A travelling crane of 20 tons capacity will make the handling of machinery in this station an easy matter. Space has been provided for an additional unit of 700 K.W. in water wheels and generator whenever it may be desired to install it.

This building will be the main or distributing station of the company. The other two stations which were saved from the fire, one a water power station and the other a steam station, will, after being somewhat remodelled and modernized, be used as auxiliaries and reserve stations, current generated in these being transmitted to the distributing switchboards in the main station.



DISTRIBUTING STATION, OTTAWA ELECTRIC COMPANY—VIEW FROM THE WEST, SHOWING PONDS AND RACKS.

MOND FUEL GAS.*

THE possibilitity of using cheap fuel and of recovering its ammonia has been the subject of Dr. Mond's experimental work on gas producers, which was started in 1879 and has been carried out on a large scale for a number of years at Winnington, Cheshire, England. This work resulted in the solution of the difficult problem of converting the cheap forms of fuel into a good gas of uniform quality in such a way that the ammonia existing in the fuel is not destroyed, but recovered as a by-product. Common bituminous slack, brought by railway wagons into the works, is mechanically handled by elevators and creepers and deposited in hoppers above the producers. From these, it is fed in charges of 8 to 10 cwts. at a time into the producer "bell," where the first heating of the slack takes place, and the products of distillation pass downward into the hot zone of fuel before joining the bulk of the gas leaving the producer. The hot zone destroys the tar and converts it into a fixed gas, and also prepares the slack for its descent into the body of the producer, where itis acted upon by an air blast, which has been saturated with steam at 85° C. (185° F.), and superheated before coming into contact with the fuel. Unlike what is done in other producers, the quantity of steam introduced into the blast is relatively large, and amouts to ½ tons for every ton of fuel gasified. This large quantity of steam keeps down the working temperature of the producer within such limits as to prevent the formation of clinkers or the destruction of the ammonia, yet permits the fuel to be so thoroughly burned that good ashes are obtained. Half a ton of steam is decomposed in the producer for every ton of fuel burned, yielding thereby free hydrogen to the extent of 29 per cent. by volume in the final gas. The hot gas and undecomposed steam leaving the producer pass first through a tubular regenerator in the opposite direction to the incoming blast. An exchange of heat takes place, and the blast is still further heated by passing down the annular space between the two shells of the producer on its way to the fire grate; then the hot products from the producer are further passed through a "washer," which is a large, rectangular, wrought-iron chamber with side lutes; and here they meet a water spray thrown up by revolving dashers, which have blades skimming up the surface of the water contained in the washer. The intimate contact thus secured causes the steam and gas to be cooled down to about 90° C. (194° F.), and by the formation of more steam, tending to saturate the gas with water vapor at this temperature, the bulk of the sensible heat is converted into latent; then passing upward through a lead-lined tower, filled with tile to present a large surface, the producer gas meets a downward flow of acid liquor, circulated by pumps, containing sulphate of ammonia with about 1 per cent. excess of free sulphuric acid.



DISTRIBUTING STATION, OTTAWA ELECTRIC COMPANY—INTERIOR OF MAIN [illegible], SHOWING RACKS IN THE DISTANCE.

*A paper read by Mr. H. A. Humphrey, M. I. M E., at the Institute of Mechanical Engineers, London.

Combination of the ammonia of the gas with the free acid takes place, giving still more sulphate of ammonia, so that to make the process continuous, some sulphate liquor is constantly withdrawn from circulation and evaporated to yield solid sulphate of ammonia, and some free acid is constantly added to the liquor circulating through the tower. The gas, being now freed of its ammonia, is conducted into a gas-cooling tower, where it meets a downward flow of cold water, thus further cooling and cleaning it before it passes to the various furnaces and gas engines in which it is used. The cooling of the gas with its burden of steam results in the condensation of the steam and in raising the temperature of the cooling water, so that the latter leaves the bottom of the tower as hot water, which is utilized in a third tower, called the "air-heating tower," through which the air blast from the blower is directed. Here, the contact of hot water and cold air gives cold water and hot air, saturated with water vapor at 73 C. (163 F.). By this method of utilizing the heat of the gas from the producer, nearly 1 ton of steam is added to the producer blast for every ton of fuel gasified; and this cyclical exchange of heat is always going on, and forms one of the distinctive features in the economy of the process. The hot water from the gas-cooling tower is circulated through the air-heating tower, and being thereby cooled is again pumped up to the top of the gas-cooling tower. Both towers are filled with tiles, to give large surfaces of contact, and the circulating water acts as the heat-carrying agent between the hot gas and the cold air. The charging of the fresh fuel into the top of the producer and the withdrawing of ashes from the bottom in no way interfere with the continuous steady work of the producer. Also, the large volume of steam employed acts as a most perfect regulator in keeping the quantity of gas uniform. Each Mond producer of the ordinary size used at Winnington is capable of gasifying 20 to 24 tons of slack per day of twenty-four hours, and the volume of gas furnished from 1 ton of fuel fed into the producer varies from 140,000 to 160,000 cubic feet, according to the quality of the slack, and is sufficient to develop 2,000 indicated horsepower hours when utilized in a gas engine. The value of the sulphate of ammonia recovered from 1 ton of fuel is, at present prices, 8s. ($1.94), naked at the works.



DISTRIBUTING STATION, OTTAWA ELECTRIC COMPANY.—VIEW OF DYNAMO ROOM FROM EAST END.

MR. HAROLD W. BUCK.

Mr. Harold W. Buck, whose portrait is here presented, holds the position of electrical engineer of the Niagara Falls Power Company and its allied corporations. He is one of the youngest men in the electrical profession to have attained a position of such importance. He is made the subject of a sketch by the Electrical World and Engineer, from which we learn that he is now in his 28th year.

Mr. Buck graduated from Yale University in 1894, and afterward took a post-graduate course at the Columbia School of Mines, receiving the degree of E. E. in 1895. For some years he was employed by the General Electric Company at Schenectady, where he displayed an unusul degree of originality and inventive genius. He devised a three-phase motor operating by static induction and took out several patents for electrical and mechanical devices. With two associates Mr. Buck devised and patented a process for making corundum in an electrical furnace. This process is now being applied in a plant at Niagara Falls which will manufacture 5,000 tons a year of the finest corundum. During the latter part of his engagement with the General Electric Company he acted as one of the assistants to the engineer of the lighting department.



MR. HAROLD W. BUCK.

In September of last year Mr. Buck was appointed electrical engineer of the Niagara Falls Power Company, the Cataract Power & Conduit Company, of Buffalo, the Tonawanda Power Company, and the Canadian Niagara Power Company. He will direct the selection and arrangement of the electrical equipment for the large development of the Canadian Niagara Power Company which has just been commenced on the Canadian side.

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Correspondence is invited upon all topics coming legitimately within the scope of this journal.

The "Canadian Electrical News" has been appointed the official paper of the Canadian Electrical Association.

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One Question. We wish every reader of the ELECTRICAL NEWS to submit one question this month for our Questions and Answers Department. Think out a point on which you desire enlightment—whether pertaining to the boiler room, the dynamo room, line construction, or to methods of management. An effort will be made to give an intelligible and helpful reply.

Crude Oil as Fuel We have been asked regarding the extent to which crude oil is used as fuel for heat purposes. As far as can be learned oil is not employed at all for this purpose in the east, as it cannot compete with bituminous coal. On the Pacific coast, where conditions are more favorable, it is used quite extensively. One pound of oil will evaporate about twice as much water as a pound of coal, so that where oil is more than twice the price of coal per unit of weight it is preferable, as it is more cleanly to handle and permits more work to be gotten out of a given installation of boilers.

Electric Lighting Statistics. A report recently issued by the Department of Labor at Washington affords conclusive evidence of the almost universal use of electricity for public lighting in the large cities of the United States, and also that with few exceptions the light is supplied under contract by private companies. Out of 135 cities, only one (not reported) is without an arc lighting system. The younger and progressive cities especially show preference for electric light, 43 of such cities being entirely dependent on arc lighting. While public ownership of water-works systems is found to be the rule, only 11 out 135 cities own and operate their own lighting plant, and some of these such as Springfield, Ill., lease it to a private company.

Liquid Air. A year or two ago the public were startled by an article in one of the leading American magazines which claimed that a process had been discovered for manufacturing liquid air in unlimited quantities and at a very moderate cost. It was further claimed that means had been found of applying liquid air to the generation of power—that in short, liquid air was a kind of perpetual motion machine, by means of which power could be generated continuously at little or no cost. The statements contained in this article were scouted by persons competent to judge of their value, but as usual many of the readers of the article who had not the knowledge requisite to enable them to judge of the practicability of the claims made were induced to invest their money for the promotion of the new (?) discovery. Very little has since been heard about liquid air, but it is now learned that the company which was formed to promote the so-called discovery has become bankrupt.

The Assessment of Electrical Companies. In connection with the appeals of the Toronto Street Railway Company, the Toronto Electric Light Company, and the Bell Telephone Company against the assessmenrs imposed on their properties by the city of Toronto, the Courts have decided in favor of the companies. In imposing heavy assessments on these companies, the city interpreted certain legislation passed

by the Ontario Legislature at its last session to mean that what has come to be known as the "Scrap Iron Assessment" decision by the Courts was no longer in effect. The Courts have decided in the present case, however, that this decision is in no way affected by the legislation referred to, and on this ground the appeals of the companies have been allowed. The newspapers are consequently in a rage, and are repeating many of the absurd statements regarding the companies which appeared when the Conmee Act was before the Legislature. The fact that a number of men bind themselves together in a business enterprise instead of investing their money separately appears to be sufficient to make them the mark for attack on the part of the newspapers, while strange to say the man who invests his money in an individual enterprise is spoken of in the light of a public benefactor. Just where the difference comes in is hard to determine. So far as can be learned there is no desire on the part of the electrical companies to escape their fair share of taxation, as is proved by the case of the Toronto Electric Light Company, one of the appellants in the case which has just been decided. The amount paid in taxes by this Company on their machinery and plant has been in proportion to their receipts, while in addition they have been taxed in the usual way on their buildings and land. This company may be taken as a fair example, being a well managed concern. If any change is thought to be necessary in the method of assessing electrical companies, the most equitable plan would seem to be the one suggested to the Legislature last year, namely, that the assessment on machinery and plant should be based on the total receipts of the business, while the buildings and land should be assessed separately in the usual way. This method would be likely to give satisfaction to all parties concerned. There would be no difficulty in ascertaining the amount of the total receipts of each company, as the figures are made out yearly for the shareholders and in the case of the larger companies are distributed in printed form.

High Speed Electric Traction.

At the International Engineering Congress held in Glasgow on September 4th last, a paper was presented by Mr. O. Lasche, giving particulars of some of the experiments which have recently been made near Berlin to demonstrate to what extent a very high rate of speed is practicable on railways with electricity as the motive power. The experiments in their first stage related only to the construction and testing of the car, which had been specially designed for high speed service. This car is about 22 meters in length, and in cross section conforms to the standard German state railway carriages. It will accommodate about 50 passengers. All parts carrying current are contained in closed compartments to prevent the possibility of injury to passengers. The motors, which are 3-phase 250 h. p. with a maximum capacity of 750 h. p. are directly attached to the car, no locomotive being employed. The car body is carried by two bogies, or trucks, each with three axles, of which the center is only a running axle. The sole effect of the designer was to construct a car capable of running long distances at the highest possible speed. The weight, which for an output of 8,000 h. p. was originally 50 tons, was subsequently reduced to 30 tons by modifications in the apparatus. A liquid starting device that could be equally well used for large winding engines was designed. The author of the paper states that from the results obtained in the preliminary trials, there is every reason to hope that the motor car will meet all requirements, and enable the association to deal with the questions relating to the running of the car on the track. In the following discussion Sir Wm. Preece warmly commended the candor with which the methods employed in the experiments had been described. He also strongly advocated the three-phase system, and said that three-phase was really more continuous than a continuous current, i. e., if the energy curve of a three-phase set of waves be plotted, it would be found to be a straight line. In further comparing the two systems, he said that the three-phase saves 30 per cent. in weight of machinery, and by using 3,000 volts pressure on the line the cost of conductors is greatly diminished, and 40 per cent. at least saved in capital expenditure. A representative of the association which is conducting the experiments remarked that owing to the railway monopolies and the absence of railway competition in Germany, it would not be surprising if Great Britain, which was the pioneer user of the steam locomotive should also be the first to use high speed electric railways of great length. It is to be hoped that in due time we shall learn of the successful completion of these important experiments involving another great step forward in electrical development.

ACETYLENE GAS EXPLOSION.

The firm of Shaw & McKerracher, of Perth, Ont., have been using acetylene gas for lighting purposes. A short time ago while Mr. Shaw was wiping around the machine, a small quantity of gas which had not been drawn off ignited, and severely burned his hands and face. Last month a more serious explosion took place. According to the Perth Expositor, Mr. Ditrick, the agent for the machine in Perth, and Mr. Richard Walker were about to make some repairs to the machine. Feeling satisfied that all the gas was out of the machine, Mr. Ditrick disconnected the piping. As the machine was turned over the small quantity of water remaining in the tank below the fawcet ran to the lowest edge of the tank and the gas still remaining was forced out. A lamp was procured, whereupon the gas ignited, causing an explosion. One part of the machine was hurled forward with considerable violence, breaking down the partition, and the burning gas struck Mr. Walker in the face and on his arms. He was badly burned, and it is feared that his eyesight may be injured. Mr. Ditrick was less seriously injured, although he has since been confined to his house. The explosion was heard several blocks away. It is said that Shaw & McKerracher have decided to discontinue the use of acetylene gas.

The ratepayers of Grimsby, Ont., have voted down a proposition to buy the electric light plant of J. W. Van Dyke.

The suit in which the Ottawa Electric Company, Hull Electric Company and corporation of Hull are interested, concerning the monopoly of street and domestic lighting within the limits o Hull, will shortly be heard by the Privy Council of England.

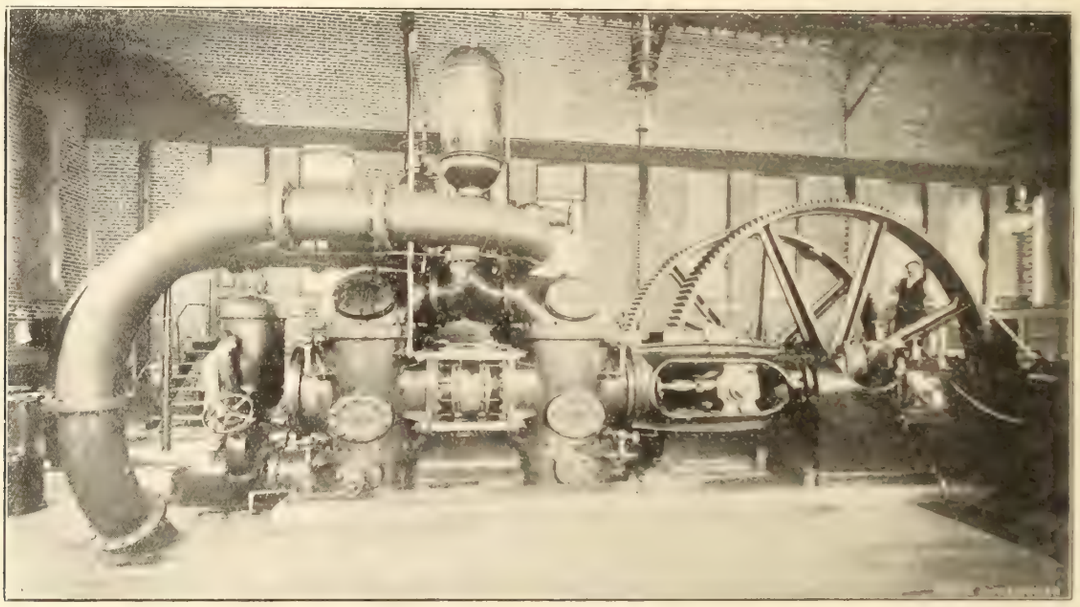
Ald. J. S. Askwith is about to commence the improvements to the water power of the Capital Power Company at Deschenes, Que. The work will consist chiefly in cutting a large channel about 200 feet long to a depth of 7 feet beneath the surface of the water. It is hoped by this means to add about 3,000 horse power to the present capacity.

ELECTRICALLY DRIVEN POWER PUMPS.

The most important electrically driven power pumps yet installed in Canada are those for the Monrteal Water and Power Company, manufactured by the Northey Company, Limited, Toronto. They consist of two horizontal triplex pumps, one at the St. Gabriel Station, erected in 1899, and one at the Clarke Avenue Station, erected this year. The pumps are similar in design, so that a general description of the first machine will serve for both.

The pump at St. Gabriel has three double-acting outside-centre packed plungers 21 inches diameter by 24 inches stroke, made of hard, close-grained iron, working in deep phosphor bronze bushings, which form the neck bushes of the packing boxes. The packing box glands are also lined with bronze, and are fitted with supplementary packing glands to take up any drip which may pass the main packing. The pump rods are of solid tobin bronze, a taper fit in plungers and crossheads, securely attached to the former by bronze lock nuts, and to the latter by steel cotters. The crossheads are heavy steel castings fitted with adjustable shoes of bronze. The guides are cylindrical in shape, with large openings in each side to give access to crossheads and glands of pump rods; they are turned and faced at each end to fit the pump cylinders and main frames respectively, and bored out to receive the crosshead shoes, so that each pump is in accurate alignment with its guide. The construction of the water end is as follows: The front and back end of each pump is formed by two cylinders intersecting each other, and is cast in one piece with the suction and discharge decks, which are massive flat plates heavily ribbed on under side between each valve seat, access being had to the valves through ample hand holes in pump body and in the force chambers on top.

The pump valves are of medium hard rubber 4 inches diameter, and the springs are of phosphor bronze, a brass plate being interposed between spring and rubber with a grooved recess to keep spring in place. The valves in each deck are 36 in number, giving a valve area of 60 per cent. of plunger area; so that the mean velocity of water through the valve openings is about 135 feet per minute for a plunger speed of 80 feet. The two portions of each pump are rigidly tied together by four steel rods 3 inches diameter. The bottom flanges are faced off and bolted to suction base, one base receiving the two ends of each pump; and the top flanges are faced to receive the force chambers. As the suction deck is part of the pump cylinder casting, the joints at suction base are not subject to pressure. Each suction base is provided with a relief valve, set to open at 20 pounds per square inch, in order to provide against any possible accumulation of pressure between suction deck and foot valve when pump is at rest. The force chambers are semi-spherical in form, with ample discharge openings near the top. Each pump is provided with large air chamber, with automatic air charging device attached to each. Gate valves are placed in suction and discharge connections to each pump, so that any one pump, or any two pumps may be used, and the other disconnected. The discharge pipe from each pump is also provided with a 6 inch spring-loaded relief valve, which is used in starting the pumps, as well as to relieve an excessive pressure automatically.



ELECTRICALLY DRIVEN POWER PUMP BUILT FOR THE MONTREAL WATER AND POWER COMPANY

The suction in entering makes a complete circuit of the three pumps, a run-around pipe or loop being placed at the opposite end of suction bases to that by which the main suction enters. The suction pipe to each pump is 16 inches diameter, being joined by easy angles to the common suction pipe, which is 24 inches diameter. A large vacuum chamber is placed immediately over the vertical pipe, through which the suction is led to the pumps. The discharge connections from each pump are 14 inches diameter, uniting by easy angles and bends into a common discharge of 20 inches diameter.

The pump has a rated capacity of 5,000,000 Imperial gallons in 24 hours, when making 20 revolutions or 80 feet plunger speed per minute, and is connected by a friction clutch to a 450 h.p. synchronous motor of the S.K.C. type, made by the Royal Electric Company, of Montreal. This motor runs at 180 revolutions per minute on 66 cycles at 2,400 volts.

The gearing is single reductions about 9 to 1, one

pair of gears on each side of central pump. The large gears have 160 teeth, and pinions 18 teeth, pitch 3½ inches. The crank shaft is a solid steel forging, 10 inches diameter in journals and crank pins, two journals and centre crank to each pump. The main bearings are four part boxes of tough bronze lined with best quality of babbit metal, and fitted with wedge adjustment back and front. The connecting rods are also fitted with bronze boxes lined with hard babbit, and have wedge adjustment.

This pump was built for a working pressure of 110 lbs. per square inch, but by reason of the exigencies of the service was worked for over a year against a pressure of 130 to 135 lbs. Very careful tests of the pump have been made by the engineers of the Montreal Water & Power Company to determine its efficiency. The first test was made when working against a pressure of 110 lbs. A standard Weston watt-meter was used to obtain the true watts, and Crosby indicators to determine the horse power delivered at discharge deck of pumps. The test showed an efficiency of 85 per cent., that is, the horse power compared from the indicator cards was 85 per cent. of the electrical horse power at the motor. The voltage during this test was 2,240 volts.

A second test was made after a booster had been placed in the circuit to raise the voltage to 2,400, the pressure on the pump being increased at the same time to 140 pounds. On this occasion the horse power, computed from the cards, was 376, while the watt-meter showed the electrical input at 430, thus giving an efficiency of 87.4 per cent. from the switch-board to the discharge deck of the pump. The same efficiency was also obtained when the pressure was reduced to 127½ pounds.

The pump at the Clarke Avenue Station is similar to that just described, but the plungers are 19½ inches diameter, 24 inches stroke, and the pump built for a working pressure of 175 pounds per square inch. The proportions are somewhat heavier on account of the greater pressure pumped against.

Much credit is due the Northey Company for the mechanical construction and successful operation of the pumps.

TESTS OF A STEAM TURBINE.

Some recent tests of a 300 horse power DeLaval turbine, directly connected to a Ganz dynamo, were reported in August. Since then, says the Engineering Record, some interesting figures of the performance of a turbine driven centrifugal pump operating under a head of 588 feet have been received. The pumping unit was a steam turbine fire engine, of 50 effective horse power, run at a speed of 20,000 revolutions per minute. It consisted of a high pressure centrifugal pump coupled directly to the turbine shaft and of a low pressure centrifugal pump mounted on the secondary shaft, which is connected by a 10 to 1 reducing gear. The low pressure suction was 4.92 inches in diameter and the pump delivered to the high-pressure pump which discharged through a 3.94 inch pipe. The head in the test was varied by a throttle valve. The results are as follows, steam, about 117 pounds pressure :

Total head, ft.	165.6	279	326	489	588
Gals. of water per sec.	7.28	7.09	6.73	5.07	3.4
H-P in water pumped	18.6	30.	33.8	38.2	30.7
Steam per water H-P per hour pounds...	96.8	67.2	61.6	57.3	67.

RETIREMENT OF MR. W. H. BROWNE.

A dispatch from Montreal dated October 26th states that Mr. William H. Browne, General Manager of the Royal Electric Company, has tendered his resignation, to take effect three months hence. Mr. Browne assumed the position which he now occupies in 1893, having previously been manager of the United Electric Light & Power Compan, yand held other important positions in the United States. He was connected with the early development of the electric railway, and previous to coming to Montreal had gained wide and valuable experience in connectiou with the adaptation of electricity for light and power. This experience, coupled with unusual executive ability, has enabled him to do valuable work in his present capacity. When he took charge of the Royal Electric Compauy in 1893 its affairs were not in a promising condition. During Mr. Browne's regime the company's stock has constantly advanced in price as the result of his careful yet progressive management.

While residing in Montreal Mr. Browne has taken a most active interest in all matters affecting the welfare of that city. He has also been a valuable adjunct to the Canadian Electrical Association, of which he was elected President three years ago. For some time past Mr. Browne has not enjoyed good health, and it may be that to this cause is due his decision to relinquish the heavy responsibilities which have rested upon him for so many years and which he has so successfully discharged. We have not learned what his intentions are for the future, but trust that he may still remain in Canada, where he has so many friends and admirers.

MOONLIGHT SCHEDULE FOR DECEMBER.

Day of Month.	Light.	Extinguish.	No. of Hours
	H.M.	H.M.	H.M.
1....	" 5.00	P.M. 0.30	7.30
2....	" 5.00	" 1.30	8.30
3....	" 5.00	" 2.30	9.30
4....	" 5.00	" 3.30	10.30
5....	" 5.00	" 4.30	11.30
6....	" 5.00	" 5.30	12.30
7....	" 5.00	" 6.15	13.15
8....	" 5.00	" 6.30	13.30
9....	" 5.00	" 6.30	13.30
10....	" 5.00	" 6.30	13.30
11....	" 5.00	" 6.30	13.30
12....	" 5.00	" 6.30	13.30
13....	" 5.00	" 6.30	13.30
14....	" 5.00	" 6.30	13.30
15....	" 5.00	" 6.40	13.40
16....	" 8.45	" 6.40	9.55
17....	" 9.45	" 6.40	8.55
18....	" 10.50	" 6.40	7.50
20....	" 0.00	" 6.40	6.40
21....	A.M. 1.10	" 6.40	5.30
22....	" 2.20	" 6.40	4.20
23....	" 3.30	" 6.40	3.10
24....	" 4.40	" 6.40	2.00
25....	No Light.	No Light.	
26....	"	"	
27....	"	"	
28....	P.M. 5.10	A.M. 10.10	5.00
29....	" 5.10	" 11.10	6.00
30....	" 5.10	" 0.10	7.00
31....	" 5.10	" 1.10	8.00
		Total.....	255.45

LEGAL.

The Boston Gas Light Company and the Edison Electric light Company of Boston, have been declared jointly liable for damage caused by an explosion of gas in a Boston subway in March 1897. The explosion is supposed to have resulted from the contact of a spark from a defectively insulated underground electric conductor with an accumulation of gas in the subway. It is held that the explosion might have been avoided if a man had been appointed to ventilate the subway at intervals.

QUESTIONS AND ANSWERS

"Enquirer:" I would be much obliged if you would answer in the "Questions and Answers" column of the next number of the ELECTRICAL NEWS the following question, viz: What number of watts per lamp are required to furnish or supply the requisite energy to produce the full lighting power of the arc electric lamps of 2000 candle power which has been used for street lighting for some years back? Also what number of watts per lamp are required to supply energy to the alternating current arc lamp of 2000 candle power to give the standard of light now required for city street lighting by lamps of 2000 candle power?

ANS.—The arc lamp which is usually rated at 2000 c. p. is the open arc direct current series lamp in use for so many years, taking 9.6 amperes at 45 to 50 volts, or an average of 450 watts each, but latterly as the matter has been investigated in connection with the growing use of the enclosed arc, it has been found that the practice of rating by candle power is not a satisfactory method, as it but paves the way for an endless series of disputes, due to there being so many ways of measuring the light emitted. In view of this, the method of rating by candle power is being dropped wherever practicable, the consumption of the lamps in watts being given instead. It is considered that a series alternating lamp taking 6.6 amperes, and a voltage varying with the frequency, whose watt consumption is about 425, gives the same general average illumination as the old open arc 9.6 amp. lamp, though the light from it measured at some angles will be greater, and again at others less, than that emitted by the latter.

" Ambition" writes: Would you please describe the construction of an electric radiator or heater?

ANS.—Any and all substances carrying electric currents have their temperatures raised when the current is flowing, and thus give off heat to the medium surrounding them. In wiring for light or power the conductors are made of such a size that the drops are uniform and that the losses are as small as possible commensurate with the cost, which means that the heat given off by them is practically imperceptible, but in making a radiator, heat being the desired result, the conductor is made of such style, shape and material as will give the greatest amount of heat with the least expenditure of energy. The heat which in practice is obtainable from a given amount of energy is limited by the temperature which the conductor will stand before oxidizing, and in order to raise this temperature to the highest point, some manufacturers use wire whose composition is more or less a secret, being made from some of the rarer metals, mounting the spirrals in an non-combustible and insulating frame, usually of iron and porcelain; other wires are made almost entirely of iron and imbed it in sand or cement, which has the effect of keeping the air away and thus allowing the heat to be greater than if the conductor were in the open air, in which case it would burn at a much lower temperature. It is not practicable for any but those commercially engaged in their manufacture to make a heater which shall be reasonably efficient, but if efficiency does not appreciably affect the case, a very serviceable article can be made from ordinary galvanized iron wire, the necessary size and length, in the absence of any information as to size of room you desire to warm, being a matter of experiment. If for alternating cnrrent care should be taken to wind it as much as possible non-inductively, and to thoroughly secure all the parts, or else the humming will be very loud and disagreeable.

"Subscriber" asks: 1. How would you connect a Reliance arc dynamo? Supposing the machine had all parts disconnected, where would the fixtures, such as voltmeter, ammeter and rheostat, if there be any, be connected?

2. What would be the best way to set the brushes if there were four in circumference?

3. Should there be lubrication used on the commutator of a dynamo?

ANS. 1. All the field coils are connected in series, these again going in series with the armature, the two leads left being connected through the ammeters to the lamp circuit. If there is a voltmeter provided it would be connected across the line, though it is an expensive instrument and not usually provided with arc machines, especially those manufactured at the date the Vaston machine was on the market. No rheostat is used with this machine; when put on arc generators it is generally connected in parallel with the fields.

2. In a multipolar machine with four brushes they would be set either ¼ of the circumference apart or else spaced with the same arc between them as between two poles, and either opposite or between the latter, depending on the way the winding is connected If the machine has only two poles, the brush holders are usually moveable so as to alter the relative position of the two pairs of brushes as the load changes.

3. All the commutators require lubrication; those that have much sparking taking place on them will need more than those running without sparking. As a general rule the more sparking there is, and therefore the greater the heat of the commutator, the stiffer should your lubricant be, a heavy grease giving good results, whereas for the latter an oil will generally be found preferable. It is a good plan to have two or three sets of brushes, where they are of carbon, and boil them occasionally in paraffine. Copper brushes should be soaked once in a while in coal oil or benzine, to cut out the dirt which will cake in the ends and cause heating and sparking. Whatever lubricant is used, care should be taken to prevent its getting round the edge of the commutator and into the end micas, as it destroys the insulation and induces grounds, also it collects and holds dust whenever it is not wiped clean. Sandpaper should not be used unless the commutator has got rough; the longer it will keep a good surface without being polished the better, leave it alone for years even if it will stay that way.

" B. W.," Montreal: How do you determine the number of incandescent lamps that can be run in series off the primary alternating lines?

ANS.—The number depends on the primary voltage of the circuit and the amperage and the candle power of the lamps, thus a 50 candle power lamp, taking say 3 watts per candle, will have a total consumption of 150 watts. If it is for a 5 ampere circuit it will therefore take 30 volts across its terminals, and a primary line

potential of 2,100 volts would evidently supply 70 such lamps. It should be noted that the greater the amperes the greater number of lamps which can be run, also that in this system of lighting, unless provided with a regulator, the number of lamps on the circuit is invariable; any decrease from the proper figure results in too much current and burnt out lamps, any increase gives not enough current and thus poor light. The rule given above can conveniently be put in the following equation : Number of lights =

$$\frac{\text{primary voltage x ampere.}}{\text{candle power x watts per candle}}$$

BY THE WAY.

Capt. Thomas Bixby, under whom Samuel M. Clemens (Mark Twain) served as pilot and "engineer" on the old Mississippi River boat Swallow, has given the following description of the engine of the Swallow : "The swallow had the queerest sort of engine that was ever seen. The craft itself was a little shaky—it only plied between St. Louis and Cairo—being about thirty feet long, with a stern wheel, a place for freight and passengers, a pilot-house, and a place on what may be called the pilot-deck for the engine. That engine went aboard when it was needed, and only then. It burned no wood nor coal, but ate a powerful sight of grass. It was a large gray mule named Jerry, which worked a treadmill that propelled the boat. Sam Clemens—you know his name of Mark Twain came later—was chief engineer and pilot. He had a system of signals and they were ingenious. By pulling a cord he could raise a head of cabbage just out of the reach of the mule. The engine would start for it, and begin to walk after it, and the boat floated majestically on down the river or up, as the case might be. When Sam wanted to stop he would pull a rope attached to the feed box of the engine. Without intending to be personal, I will say that Jerry was one of the most intelligent animals I ever met. His voice was more on the order of a fog horn than a whistle—it was too much of a baritone for the latter. When Sam wanted to whistle for a landing he hit Jerry with a stick. If he wanted, in the profane language of the river pilot, to go ahead like the ——, he gave Jerry a touch of the whip."

* * *

Under the heading "Book Reviewing by the Boiler Inspector," The Locomotive prints the following : "We have received from the publishers a copy of 'An Englishwoman's Love Letters,' with a request that we give it a review in The Locomotive. We have no regular love-letter editor on our staff, and we therefore turned it over, first, to our expert on riveted joints, who is reputed to have had some experience in such matters. He says that the writer of the letters is badly designed ; that she has a poor circulation, and a cracked head, and that a few bricks are loose in her setting ; and he swears he will take no responsibility for her, until she has been submitted to a hydrostatic test of at least a thousand pounds. His judgment has always been good on matters more directly in his line, but we were so sure that it was in error in this particular case that we took the book away from him and made a complete internal inspection of it ourselves. We quickly found that the language is so warm that our expert on combustion was the proper man to consult. He was on his vacation, however, and we didn't want to call him back to make a calorimeter test during this hot weather. Our chemist shook his head sadly when we offered the job to him, and the only available man left on our staff was the automobile editor, who takes the place of the horse editor, that we discharged when the horse went out of fashion. He says the author has wheels all right. He doesn't wish to condemn the book, though, for he says that while it isn't in his line, he should judge that it would be hot stuff in somebody else's line. With this sentiment we heartily agree. It is our custom, in reading a work of fiction, to pick out the one passage in the whole book that seems to be most pat. We think we have found it, in this book, on page 203, where the author of the letters says to her hubby, "Oh, how tired loving you now makes me !" To which we would fervently respond, "Amen !"

NEW STORAGE BATTERY FOR McGILL.

Some additions and alterations have been recently made in the electrical equipment and arrangements of McGill University, Montreal. The most important acquisition is a 300-kilowatt power storage battery, the current from which will be used for light and experimental purposes when it it is not desirable to use the steam plant. The whole of the Macdonald building could be lighted up by its current, so that by charging it during the day, work could be carried on at night without having recourse to the steam plant. For charging the battery one of the 50-horse power steam dynamo units of the present plant has been remodelled. Much auxiliary apparatus, such as switch-boards and metering devices, have also been installed.

The Macdonald Physics Buildings has been completely rewired, so as to conform in every particular with the highest insurance requirements. All the overhead wires of the lighting plant of the Macdonald Buildings have been removed, and replaced by highly insulated lead-covered cables. By this means the appearance of that side of the campus has been greatly improved, and the danger of interruption of the current through snow or ice falling from the buildings has been entirely obviated.

EXPERIMENTS WITH BOILER TUBES.

Certain experiments have been made on the Oudh and Rohilkhand Railway with lap-welded steel tubes with the following result :—Lap-welded steel tubes have been put into boilers of engines, B class 81, C class 107 and 118, D class 126 and 133. The first boiler done being No. 133, which started work with them in February, 1899. All these boilers have a working pressure of 120 lbs of steam only. One tube of engine No. 133 was drawn out in order to see its condition on 9th September, 1900, after it had been in use 19 months and run 70,541 miles, and found that it showed signs of pitting all over, and especially in one place, about 18 inches from smoke box end. These tubes have given no trouble at all as regards leaking and have proved satisfactory so far, but it may be stated that the water on the O. and R. line is good at the stations where these engines take it. The price at which these were issued to the Loco. Department was Rs. 3-4-0 each and the rate for brass tube at the time was Rs. 11-8-0.—Indian Engineering.

JUDGMENT AFFECTING ASSESSMENT OF ELECTRICAL COMPANIES.

For the benefit of electrical companies we give below the full text of the judgment rendered in a Triune Court, Toronto, by Judges McDougall, McGibbon and McCrimmon, regarding the assessment of the poles, wires, cables, etc., of the Toronto Electric Light Company, Toronto Railway Company and Bell Telephone Company. The legal quotations and references have been omitted :

The principal point to be decided is as to whether the basis of the valuation adopted by the Assessment Department is a correct one in the light of this amendment to the Assessment Act, made at the last session of the Ontario Legislature :

" Real property belonging to or in the possession of any person or incorporated company, and extending over more than one ward in any city or town, or situate in any township, may be assessed together in any one of such wards at the option of the assessor, or the assessment of the property may be apportioned amongst two or more of such wards in such manner as he may deem convenient, and in either case the property shall be valued as a whole or as an integral part of the whole."

At the date of this enactment the Legislature had before it three cases in which the Court of Appeal for this province had discussed and laid down the basis of correct method of arriving at the value for assessment purposes of the different classes of property involved in the present appeals. These cases were determined under the various provisions of the Assessment Act as that act stood prior to the Amending Act of 1901. The first case was the Bell Telephone Company v. City of Hamilton. The Court of Appeal held in that case : (1) That the poles, wires, conduits and cables of the Telephone Company must be valued in distinct units as they happened to be located in the several wards of the city, the portion of the poles, wires, etc., in each ward by itself and not as a part of a going concern. (2) That these poles, wires, etc., must be valued at the price they would bring if sold as so much material to be removed or taken away by a purchaser. (3) If the material was not actually sold the assessment value would be the sum at which such material would be taken by a creditor in payment of a just debt from a solvent debtor.

The court was unanimous upon the point that this class of property could not be valued as a whole or as an integral part of a whole, nor as if it were a going concern ; in other words, the value of the portion in each ward must be arrived at separately apart from the rest of the work.

The next case relating to this subject was the London Street Railway case, in which, also, the court held that the ward division must be followed and each portion of what was in fact a continuous system could only be assessed in separate units in each ward, and that the several parts could not be considered as part of a going concern operated in the several wards, and the Bell Telephone case was followed as to the basis of valuation for the various ward units.

The next case was the Queenston Heights bridge assessment. In that case, which did not involve the ward divisions, the Court of Appeal also adopted the same basis of valuation to determine the assessable value of the Canadian half of an international bridge, the whole bridge being the property of one company. The so-called "scrap valuation" was applied and the assessment value of the half of the bridge on Canadian soil was placed at the value of the material to a purchaser who would have to remove and take the same away.

The Legislature, therefore, was fully possessed of the conclusions of the highest courts of this province as to the inadequacy of the machinery for assessing this peculiar class of property under the existing law, which property had come into existence subsequent to the date of the enactment of section 28 of the Assessment Act.

The court had found considerable difficulty in applying to modern railways, gas and water companies and electric telegraph companies provisions which were amply sufficient for the much more simple state of assessable property in the days when the assessment laws were first introduced. It was extremely difficult to ascertain the true value of such property. If any injustice resulted from the decisions of the courts in dealing with these perplexing problems, the remedy rested with the Legislature. In 1901 an amendment of the Assessment Act is made, and the point to be determined in these appeals is as to the extent that the new law varies or qualifies the decisions I have referred to.

The first change clearly made is to abolish the ward divisions in considering the value of these new classes of constructive real property, where the operation of such enterprises and the plant essential to their useful equipment extends territorially beyond the limits of one ward. As a corollary to this abolition of ward divisions the assessor is allowed to value the real property of the owners or possessors of such concerns as a whole in one ward, or he is at liberty to value it in more than one ward, but, in such latter case, each ward unit is to be valued as an integral part of the whole.

I interpret this to mean that, having ascertained the value as a whole, he can, if he wishes, apportion to each ward the proportionate part of the whole value which appertains to the property lying within its boundaries, but it must be at the same values. The Legislature has made proper the method suggested by a judge who said, " The correct method would be to value the concern as a whole and then apportion rateably to the wards or the municipality as much of the value as falls to that part of the concern territorially situate in each locality.

The next most important consideration will be : Has the Legislature established any new basis of valuation from that laid down in the decided cases ? Has the standard or test prescribed by section 28 of the Assessment Act been altered, namely, that the property, whether real or personal, is to be estimated at its " actual cash value, as it would be appraised in payment of a just debt from a solvent debtor ?"

The Court of Appeal has distinctly laid down that rails, poles, wires, etc., must be valued only as material to be removed or taken away by a purchaser without regard to any adventitious value it possesses to the possessor or owners only ; any special value due to franchise or income-producing qualities does not follow the property into the hands of the purchasers, and cannot be considered in valuing it for assessment purposes under section 28 of the Assessment Act.

This principle is equally applicable to the whole line of rails, poles and wires, etc., whether they are to be considered as a whole or as composed of separate parts lying in different municipal wards of a city but forming one continuous system. In Toronto, where there are six wards, six separate scrap heaps under the former law may now be treated, if the assessor wills, as one scrap heap of poles, rails, wires, etc., removed from their connection with the operating system of which they are constituent parts. They are not to be treated as parts of a going concern in good condition of repair, nor are they to be valued as the estimated or ascertained cost of reproduction less any reasonable allowance for wear and tear due to their having been in use for any definite period since their installation.

In very truth the only apparent change effected by the recent legislation is to permit a different method of municipal bookkeeping whereby, as to this special class of assessable property, the whole value may be attributed to one ward if the Assessment Department desire to so assess it, or if they do not so elect, they can distribute the total value amongst several wards in proper proportions.

Section 28 of the Assessment Act still applies to all assessments, and its force as applied to rails, poles, wires, etc., I am of opinion, must still continue to be interpreted according to the principles laid down by the Court of Appeal. So far as the method of estimating the assessment value of the classes of property involved in the present appeals is concerned I am of opinion that the amendment enacted at the last session has effected no change whatever.

The parties to the present appeals have informed the Board that they have agreed upon the value which should be determined that the assessment is still to be made upon the same principle as that laid down by the Court of Appeal before the enactment of the amendment above discussed.

I am of the opinion that the appeals should, therefore, be allowed, and the amounts of the several assessments be reduced to the figures agreed upon between the city and the appellants.

The Assessment Department have added to their assessment the value of the rolling stock or cars of the Toronto Railway Company, and the company contend that these articles are not assessable as realty. The Assessment Department has, doubtless, been led to include the Railway Company's rolling stock as realty owing to the recent decesion of the Court of Appeal in the case of the Bank of Montreal v. Kirkpatrick, when the court held that the rolling stock of an electric railway should be regarded as against an execution creditor as part of the corpus of an entire machine (electric plant), and, therefore, in the nature of a fixture, and passing with the land over which it runs.

The whole doctrine of constructive annexation to land of articles ordinarily treated as chattels, so as to constitute them really, has, in modern times received an extended application.

" The rolling stock of an electric railway," says a judge in the case referred to, " really constitutes part of one great machine, confined to a particular locality, for which it is especially constructed and fitted, operated by means of a continuous current of electricity, generated in part of the fixed plant in the power-house and passing through the trolley pole of the car, which is fitted to the overhead wire, through the car to the unbroken line of rails back to the generator. Of the entire machine thus operated the important part—the rails and power-house—are unquestionably realty, and the rolling stock forms part of it in a much more intimate and connected manner than does the rolling stock of a steam railway. Detached from the rails, it is incapable of use ; and as regards its liability to be taken in execution, it may be properly regarded as part of the corpus of the entire machine, and, therefore, in the nature of a fixture, and passing with the land over which it runs.

This decision was made in reference to an interpleader issue between execution creditor and trustees and debenture holders. If the rolling stock was chattel property, the creditors (plaintiffs) would succeed, there being no duly registered chattel mortgage covering chattel property ; if the rolling stock, like the poles and wires, was to be considered realty, and to form part of the land, then the defendants were entitled to succeed.

In disposing of the interpleader issue nothing turned upon the language of the mortgage purporting to cover the land, franchises and rolling stock. If the rolling stock was chattel property, the instrument purporting to mortgage it did not comply with the Chattel Mortgage Act, and it was not registered as a chattel mortgage. The question to be determined then was, is the rolling stock of an electric railway company personal property or

realty? The court held it was realty, and was not seizable under an execution against goods.

It appears to me, for the purpose of disposing of the question of the right to assess the rolling stock or cars of an electric road as realty, I must look upon that question as settled by the Court of Appeal in the case above referred to. Unless I have failed to properly appreciate the force of that judgment, the question is not open to consideration or decision by an inferior court.

I am of opinion that the cars used by the Toronto Railway Company on their electric road are, along with the rails, poles and wires, liable to assessment as realty, and that the value must be ascertained in the same manner as the value of the rails, poles and wires themselves.

I have been given to understand that the parties can agree upon the amounts to be inserted in the assessment roll relating to this portion of the assessable property of the company and upon handing in to this Board these figures the same can be embodied in the order. The Toronto Railway Company's appeal upon this branch of the case will be dismissed.

MONTREAL

Branch office of the CANADIAN ELECTRICAL NEWS,
Imperial Building,

MONTREAL, NOVEMBER 5th, 1901

We are told in the lay press that the Toronto illuminations for the Duke and Duchess of York surpassed anything that had been seen in Canada. Montreal happens to be in Canada, and although, of course, she cannot hope to compete in greatness with Toronto, yet we have the feeling that this story about illuminations should be told to the marines.

The resignation of Mr. W. H. Browne, general manager of the Royal Electric Company, will come as a surprise to many and to the regret of not a few. Mr. Browne in private life is a hail fellow well met, and agreeable in the extreme, as those of the electrical fraternity, both members and non-members of the C.E.A., are well aware. His loss to the C.E.A., in which he took a prominent part, will be keenly felt.

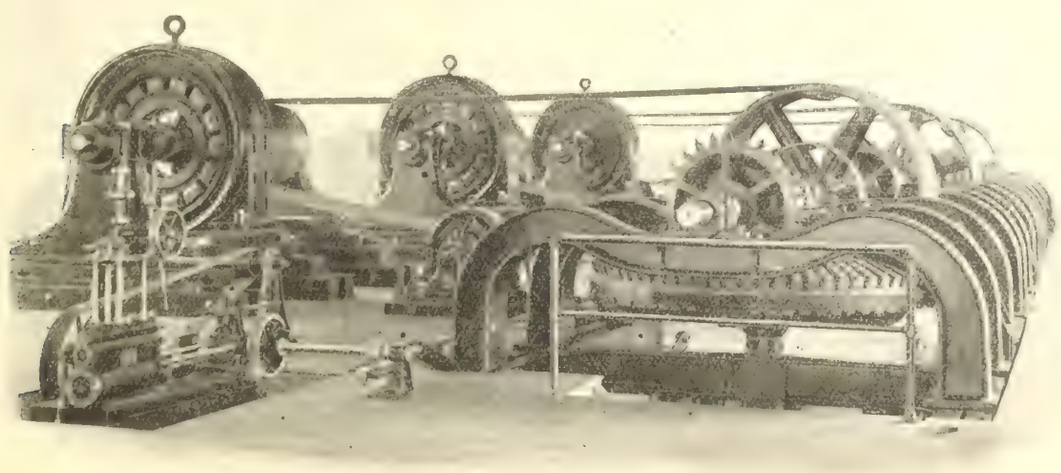
In prominent United States cities the people simply put their foot down and say they wont have night-shunting, the result being that the adoption of electric locomotives has decreased the noise in many places. Montreal with its three stations raises bedlam every night in summer; surely there is a field for some large electric firm to exploit the idea of electricity for yard work, with the chance of popular clamour behind them as an assistance.

Surely wiremen in Montreal can bring to bear sufficient influence on their employers to make a 9-hour working day for at least four months of the year, viz.: from December to March. It is simply unnecessary to have a man parading to his work cold and in the dark. As to private house work, most of them do not hold such early hours in winter in their establishments as in summer, and in unfinished buildings the extra hour is simply wasted and would be more than made up for by the fact of men working in the light and after more rest.

Old boys in the Royal Electric Company during the regime of Mr. Hagar, late general manager, who will remember the pair, Messrs. Seddal and Whyte, will be pleased to hear that they have drifted together again, and Mr. Seddal is now in the office of the Lachine Company assisting Mr. Whyte, their secretary. It would be a pleasant re-union if some of the old boys now scattered in Quebec, Charlottetown, St. John, N.B., Hamilton, etc, could have an hour's chat together and discuss old times. Although there was lots of hard work them, there was also a certain measure of fun and bon-homie which is regrettedly getting rarer.

It is on the tapis that a couple of lawsuits are in an embyro stage, being taken at the instance of certain fire insurance companies against certain electric lighting companies in this city. It is too early to comment on the case except to compare it to locking the stable door after the horse is stolen. Had the Underwriters an efficient and active inspector, on a suitable salary, and compelling inspection in each and every installation, such cases would probably never come up. Again, the fees universally collected would, even though small, nearly if not wholly recoup the salary paid. At present contractors groan under heavy fees, heavier than New York, for such voluntary inspections as may be requested by the customer.

The various companies, "Standard Light and Power," "Bell Telephone," etc., have been incensed by the proposal of one of our alderman that the "Royal Electric Company" be empowered to build a subterranean conduit to accommodate all wires; and acting under their rights secured by charter from the Legislature, have issued notice to the city separately that they will all lay conduits. Those in the trade here recognize two things, and these are: that, first, there is too much jealously in the business to allow of one company's conduit or any such deal being accomplished; and second, that none of the companies are particularly anxious to open streets at present. The lay press are trying to sensationalize the items, but the public at large are not much alarmed for their streets, at least at this stage of the game.



WESTINGHOUSE GENERATORS OPERATED BY McCORMICK TURBINES.

INSTALLATION OF McCORMICK TURBINES.

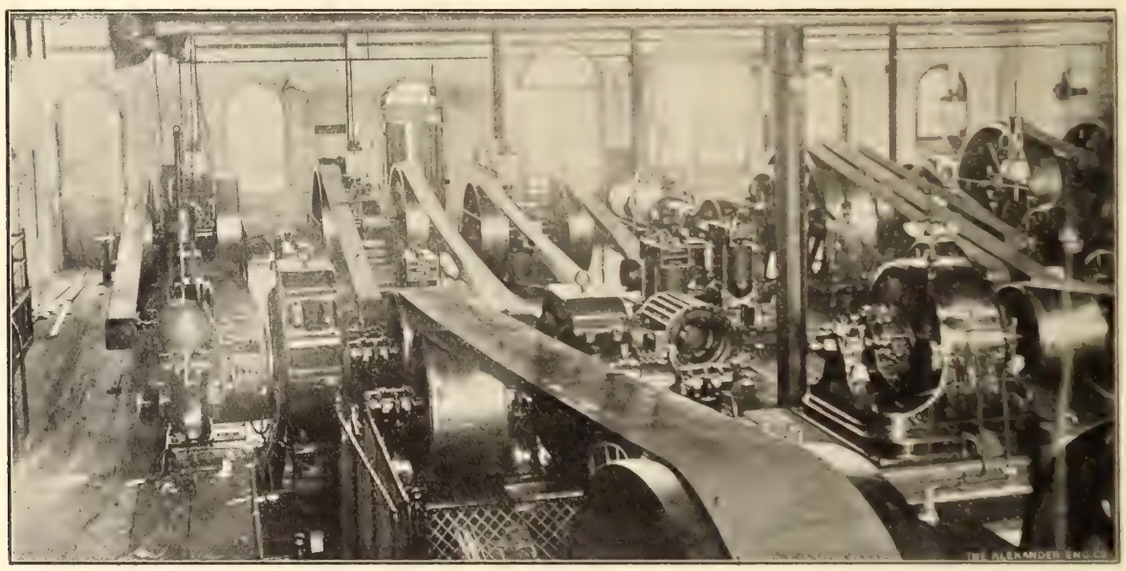
The accompanying illustration represents three belt-driven Westinghouse generators operated by four vertical shaft McCormick turbines, 72 inches in diameter, developing 3,600 horse-power under 19 feet head. This outfit was furnished to the Trade Dollar Mining Company, of Silver City, Idaho. The power is used for operating machinery in their mines. In addition to the water wheels, the S. Morgan Smith Company, of York, Pa., furnished all the machinery excepting the electrical apparatus and the governor. The gates of all the turbines are operated by one Type B Lombard governor, working in connection with a lever gate hoisting device which makes it possible to dispense with all gears used in ordinary practice.

ELECTRIC RAILWAY DEPARTMENT.

THE ST. JOHN STREET RAILWAY.

As a means of rapid transit the horse car is now a thing of the past, but in this age of automiboes and motor cars it is still interesting to glance back and trace the evolution from the slow-going means of conveyance which our fore-fathers used to the modern up-to-date systems which are now to be found in all important cities and towns. In the city of St. John the progress made in this direction is perhaps more marked than that made in many of the other cities in Canada. The first street railway system which was operated in that flourishing city was established by the Peoples Street Railway Company in 1866. This, of course, was before the introduction of electricity into general use, and when the motive power was supplied by horses. Since then many radical changes have been made. In 1887 the St. John City Company acquired possession of the system, and for five years it was operated under their control. In 1892 it was recognized that facilities afforded by a system of horse cars was not sufficiently up-to-date for a progressive city, so the Consolidated Electric Company was formed to take over the railway and change the motive power to electricity, but it retained the flat rails and stringers previously in use. This company operated for two years, and in 1894 the St. John Railway Company acquired all the rights, powers, privileges, etc., of all the previous railway and lighting companies, also the St. John Gas Light Company, and consolidated the entire system under one management.

The old rails were replaced by seventy-four pound girder rails, the work being carried out by the late Frank P. Brothers, one of the best known railway men in Canada. Three years ago the present station was remodelled and enlarged. It is a brick building 150x100 feet, with steel truss roof, the iron work being supplied by the Dominion Bridge Company, of Montreal. In the boiler room there are two 2,000 h.p. Goubert feed water heaters, manufactured by the Goubert Mfg. Company, of New York, N.Y. These are used for heating the water before entering the boilers by exhaust steam. In the engine room there are several compound engines of the most improved type, one of them being an Ideal engine of 500 h.p., manufactured by the Harrisburg Engine Company, Harrisburg, Penn.; four McIntosh & Seymour engines, one 400, one 300 h.p. and two 150 h.p., manufactured by McIntosh & Seymour, Auburn, N.Y.; one Robb engine manufactured by the Robb Engineering Company, Amherst, N.S.; five Leonard engines, 150 h.p. each, manufactured by E. Leonard & Sons, London, Ont.; one Armington & Sims, 150 h.p., manufactured by Armington & Sims, Providence, Rhode Island. The two large engines furnish power for operating the street railway and the others are used for lighting and power. The large boilers consist of two batteries of 500 h.p. each, one-half battery at 250 h.p., making 1,250 h.p. in all. These boilers were manufactured by Babcock & Wilcox, Limited. A condensing system is used, consisting of air pumps, feed pumps and condensers. A circulating pump manufactured by the Northey Company, Toronto, is used for pumping sea water for condensing purposes.

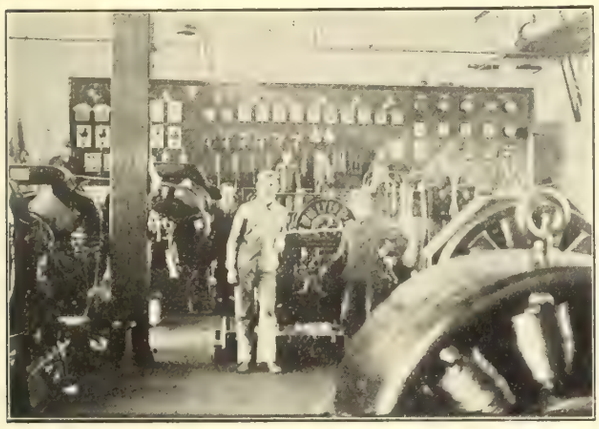


St. John Street Railway—Interior View of Power House.

In addition to the above the following electrical machines are in operation: Two 175 k.w. generators, manufactured by the Westinghouse Electric & Mfg. Co., Pittsburg, Pa.; two 200 k.w. generators, manufaetured by the Canadian General Electric Company, (these are used for street railway power); two 100 k.w. and four 45 k.w. Edison, three 1,000 light Slattery alternators manufactured by the Fort Wayne Electric Works, Fort Wayne, Indiana; one 120 k.w. alternator, manufactured by the Westinghouse Electric & Mfg. Company, Pittsburg, Pa.; one 120 k.w. alternator, manufactured by the Canadian General Electric Company; three 25, one 35, and four 50 light arc machines manufactured by the Royal Electric Company, Montreal; one 60 k.w. Brush arc machine manufactured by the Canadian General Electric Company (these being used for street and commercial lighting); four 60 light Wood arc machines, manufactured by the Fort Wayne Electric Company, Fort

Wayne, Ind. ; one 90 k.w. 250 volt generator, manufactured by Messrs. Crocker & Wheeler, Newark, N.J.

The construction of the power house and installation of the plant was carried out under the direction of Mr. M. Neilson, general manager, and involved a cost of half a million dollars. To Mr. Neilson much credit is also due for the reorganization of the company and consolidation of the plant, and his able management is responsible for the present prosperous condition of the company. Thos. Irwin is chief engineer and H. A. Brown head electrician. Both these gentlemen have been in the employ of the company for a number of years and are thoroughly proficient in their different branches. The officers of the company are : President, James Ross, Montreal ; vice-president, I. Morris Robinson, Montreal, Que. ; sec.-treas. and general manager, M. Neilson, St, John, N.B. ; directors, H. H. McLean, R. B. Emerson, James Manchester, J. J. Tucker, St. John, N.B.



St. John Street Railway—View of Switch-Board.

NEW METHOD OF CAR HEATING.

A unique method of heating street cars has been adopted in Christiania and Stockholm, Sweden. The apparatus consists of long, perforated boxes, one under each length of seats, one or both sets of apparatus being in operation as required. The boxes, which are shot in from the platform at either end of the car, are filled with red-hot coal briquettes specially prepared, so that no smoke or smell is emitted. A channel or iron sheeting runs underneath the seats, perforated on the outer side to allow the fumes or smoke to escape into the open air. On fresh air passing through a ventilator placed under the coal-box at the bottom of the car the hot combustible gases pass through this channel of iron sheeting throughout its entire length, diffusing a steady heat into the car through a set of perforated iron plates between the legs of the seats. It is found that the speed of the car causes sufficient draught, so that the briquettes are completely consumed. The temperature of 60 degrees C. is obtained even with an outside temperature of from 12 degrees C. to 14 degrees C. of frost. Last winter electric heaters were used on the electric line, but it is claimed the expense was too great, and this winter the Christiania Tramway Company, whose cars are horse-driven, and the new electric tramway both appear better sa isfied with the new method of heating their cars, as it is said a pleasant warmth is diffused without any trace of unpleasantness.

THE MONTREAL STREET RAILWAY.

At the annual meeting of the Montreal Street Railway Company, held a few days ago, the statement presented showed a net profit for the year of $649,251.51, as compared with $646,246.64 for the previous year. Out of this amount four quarterly dividends of 2½ per cent. each were declar d, leaving a surplus of $97,551.51. The sum of $23,276.67 was expended during the year on special renewals. The operating expenses for the year showed an increase of 11.32 per cent. over the previous year, due to the increased cost of coal and increased expenditure required for the maintenance of the roadbed and rolling stock of the company.

Mr. Wanklyn, the general manager, stated that the company bought its hard coal at $3.73 per ton, which was an increase of 80 cents over the previous year, but was lower than any other company in Montreal paid. In fact one large company in Montreal paid $4.05. They had a contract with the Chambly Company for power at $25 per horse-power, but could not get more than one-quarter of the 5,000 contracted for owing to delay in delivering machinery. The best the company ever did for steam power was $32 per horse-power, but last year it ran up to $37 per horse-power. Coal at $2.25 per ton would be the equivalent of $25 per horse power, which was the contract with the Chambly Company. He hoped soon to have the whole of the 5,000 horse-power from the Chambly Company. There was also a large sum spent on new tracks. The explanation was considered satisfactory, and the report was adopted. Owing to the heavy increase in insurance the directors were authorized to set aside $100,000 as an insurance fnnd out of the surplus, and to continue each year to add thereto $10,000.

The company purchased and installed two steam units capable of developing 3,000 horse-power, the policy being to have duplicate plants capable of meeting all contingencies and to provide for the increase in the company's business. It was stated that in future a monthly statement of the company's operations, showing the gross and net earnings, would be published.

The number of passengers carried shows an increase annually. During the past year the number was 46,741,660, an increase of 3,379,398 over the previous year. The number of transfers granted last year was 14,217,784, showing that nearly every third passenger was given a transfer.

The Halifax Electric Tramway Company have secured a five years' contract from the city council of Halifax for street lighting.

The city engineer of Quebec is collecting information regarding municipal electric light plants, with a view to considering municipal control in that city.

The contract for street lighting in Charlottetown, P.E.I., has been given to the Charlottetown Light & Power Company, at $69.50 per lamp for a term of five years.

A committee of the town council of Goderich, Ont., have recommended the installation of the new style enclosed arc lamp and the adoption of the meter system.

The Government of Stockholm has ordered the Director of State Railways to prepare plans for converting the steam roads to electric traction, the power for which will be furnished by the numerous water falls of the country. A recent judgment of the Supreme Court decided that most of the water powers belong to the Crown, and not, as was commonly believed, to the Riparian owners.

ENGINEERING and MECHANICS

THE METRIC SYSTEM*

By James Gill.

If I were to ask you the length of this room you would answer 40 feet, that is, you would use the unit one foot. You might also give your answer in yards. The unit in our system from which others were in the first place derived, is called the yard. That unit in any system which is taken as the standard is called the fundamental unit, and all others obtained from it by subdivision or multiplication are called derived units. Thus the yard is the fundamental unit in our system of linear measurement, and the foot and inch obtained by subdivision and rod, furlong, and mile obtained by multiplication are derived units.

The fundamental unit in the Metric System is the Metre, which s the one ten-millionth part of one-quarter of the Earth's circumference measured from the pole to the equator, and is equal to 39.37 inches, or $1\frac{1}{10}$ yards approximately.

The derived units are obtained by the use of prefixes from the Latin and Greek languages, viz.: deci, centi, milli, Deca, Hecto, and Kilo.

decimetre	(dm).	=	$\frac{1}{10}$ metre (m).
centimetre	(cm).	=	$\frac{1}{100}$ "
millimetre	(mm).	=	$\frac{1}{1000}$ "
Decametre	(Dm).	=	10 metres (ms).
Hectometre	(Hm).	=	100 "
Kilometre	(Km).	=	1000 "

The prefixes deci, centi, milli, Deca, Hecto, Kilo, are used in all the tables of the Metric System.

The great advantage in all the Metric tables is that 10 units of one denomination make one unit of the higher; thus, in the table of linear measurement we have

10 mms. = 1 cm.
10 cms. = 1 dm.
10 dms. = 1 m.
10 ms. = 1 Dm.
10 Dms. = 1 Hm.
10 Hms. = 1 Km.

Capital Dm. being used for Decametre to distinguish from decimetre (dm).

Instead of a student having to learn 12, 3, 5½, 40 and 8, as in our table, 12 inches in one foot, 3 feet in one yard, he has only the number 10 to keep in mind.

Then passing to square measure, we have, since one centimetre = 10 millimetres

100 square mms. = 1 sq. cm.
100 sq. cms. = 1 sq. dm.
100 sq. dms. = 1 sq. m.
100 sq. ms. = 1 sq. Dm.
100 sq. Dms. = 1 sq Hm.
100 sq. Hms. = 1 sq. Km.

and so in the table of cubic measure the number will be 1000, instead of 100.

1000 cubic mms. = 1 cubic cm.
1000 c. cms. = 1 c. dm.
1000 c. dms. = 1 cu. m.
1000 cu. ms. = 1 c. Dm.
1000 c. Dms. = 1 c. Hm.
1000 c. Hms. = 1 c. Km.

In our system we have an approximate relation in the statement that one cubic foot of water weighs 62½ lbs., but in the Metric system nothing was left to chance, and the relation between volume and weight is given in the exact relation one cubic centimetre of water weighs one gram. Properly I should say the mass of one c. cm. of water is one gram. The gram (gm). is the unit of mass. Hence using our prefixes we have decigram, centrigram, milligram, Decagram, Hectogram, Kilogram.

10 milligrams	(mgms).	=	1 centigram (cgm).
10 cgms.		=	1 decigram (dgm).
10 dgms.		=	1 gram (gm).
10 gms.		=	1 Decagram (Dgm).
10 Dgms.		=	1 Hectogram (Hgm).
10 Hgms.		=	1 Kilogram (Kgm).

In passing to the measure of capacity we have as our first unit the litre (l), which is the volume of one cubic decimetre, or 1000 cubic centimetres; then as before we have decilitre, (dl), centilitre (cl), millilitre (ml), &c.

Since one litre = 1000 cubic centimetres, therefore the mass of one litre of water is 1000 grams = 1 Kilogram.

*Paper read at October meeting, Hamilton No. 1, C.A.S.E.

The following are some of the approximate values of Metric units in our units.

Kilometre	=	⅝	mile
Metre	=	$1\frac{1}{10}$	yards
Centimetre	=	$\frac{2}{5}$	inch
Kilogram	=	$2\frac{1}{2}$	lbs.
Litre	=	1.76	pints

As an example of the convenience of the system, let me work out a problem or two: 1. "How many millimetres are there in 5 Kms, 6 Hms, 7 ms, 3 cms, 8 mms? Since 10 of each denomination equals 1 of the next higher, we have 5,607,038 mms, putting a 0 where a denomination is left out, as between 6 and 7 where Decametre is left out and between 7 and 3 where decimetre is omitted. Changing from one denomination to another becomes a mere matter of shifting the decimal point. 5607038 mms = 5607.038 ms. = 5.607038 Kms.

2. A box is 5 ms. long, 3 dms. wide and 7 cms. deep. How many Kgms. of water will it hold?

5 ms. = 500 cms.
3 dms. = 30 cms.
7 cms. = 7 cms.

The box, therefore, has volume (500x30x7) cubic cms., which of water weighs (500x30x7) grams = 105.000 grams = 105 Kilograms.

BOILER INSPECTION.

The following interesting extracts concerning boiler inspection are from the report of the Department of Public Works of the North-West Territories:

When the staff of the accountant's branch was increased during the year the departmental administration of the steam boilers ordinance, which is a revenue producing ordinance, was transferred to that branch from the correspondence branch, and the details of the administration are given below.

In the early part of the year the vacancy caused by the resignation of Mr. W. C. Wilson, one of the two inspectors appointed during the previous year, was filled by the appointment of Mr. W. M. Carment, of Kamsack, and in August the number of inspectors was increased to three by the appointment of Mr. William Waller, of Whitewood, this increase being necessitated by the fact that it was found impossible with two inspectors to reach all the boilers requiring inspection.

The work completed by the outside staff of inspectors, and in connection with the departmental administration of this ordinance, during the past year is summarized as follows:

Number of steam boilers inspected	509
" " examinations of engineers held	141
" " first class engineer's certificates issued	-
" " second class engineer's certificates issued	78
" " third " " " "	[illegible]
" " provisional " " "	178
" " permits for operation of boilers issued	42
Fees collected:	
For inspection of boilers	$2,430.00
" Examination of engineers	480.00
" Provisional certificates	534.00
" Permits for operation of boilers	126.00
	$3,570.00

The number of boilers inspected during 1900 shows an increase of 129 over the number inspected in the preceding year, and the number of final, first, second and third class certificates to engineers also shows a marked increase. The number of provisional certificates, as was to be expected, decreased from 304 to 178, indicating that those who had been operating engines without special qualifications are rapidly dropping out, or by passing the necessary examination are becoming the holders of a final certificate in one of the grades mentioned.

The reports of the inspectors of steam boilers indicate that the large majority of the boilers in use in the Territories are in good condition, but it will be noted that they found several boilers being operated which inspection proved unfit for use, and there is no doubt that the issue of certificates condemning these boilers has averted incidents. The reports also indicate that a large number of the boilers in use require repairs, and one of the direct benefits to a boiler owner from inspection is that he receives a written statement from an expert as to what repairs his boiler requires to put it in safe working condition.

That it is desirable to have steam boilers inspected, and properly qualified men to operate them provided, as now, [illegible]

admitted by the large majority of boiler owners, but the disinclination to pay the fee for the inspection, particularly referred to by Mr. Carment in his report, is evident from many letters received during the year.

This is, however, only one of the many cases in which the common idea seems to be that if the Legislative Assembly decide that it is necessary to do anything they should also pay for the "doing." However, I am satisfied that ere long the persons most interested will realize that the small fee collected is only a fair charge for the return they get in having their boilers inspected and provision made for their operation at a safe working pressure.

The regulations adopted in 1899 regarding the lock pop safety valves on all boilers has provided the necessary check on the pressure used, but some difficulty has been experienced in getting all boiler owners to provide these valves, and when valves have been provided and properly set and locked some complaints have subsequently been fiied regarding the pressure attained, clearly indicating what was previously suspected, that unless restrained by a locket valve from using a greater pressure than their certificate allowed, some owners had been in the habit of setting the old style valves to carry such pressure as they liked.

Four prosecutions for infringement of the steam boilers ordinance were enforced during the year, resulting in eash case in the imposition of the penalties imposed by the ordinance. It may, however, be stated that the large number of boiler owners have shown every disposition to comply with the provisions of the law, and it is, I think, generally recognized that the inspection of steam boilers is a necessary and a desirable work, considering the danger to life involved in their operation. I may, however, again direct attention to the fact that the lead of the Territories in this important matter is being followed in several of the older provinces, and that in Ontario this action is being taken upon the urgent solicitation of the engineers engaged in operating stationary engines and boilers. The experience gained in administering our ordinance during the past year indicates that some minor amendments are needed to make it work more smoothly, but with these amendments the present law certainly seems to provide for this important matter on a satisfactory basis.

CANADIAN ASSOCIATION OF STATIOANRY ENGINEERS.

TORONTO NO. 1.

The annual banquet of the above Association will be held at the Walker House on Thanksgiving Eve, November 27th. Tickets may be obtained from the members of the committee, Bros. W. J. Webb, H. E. Terry, A. M. Wickens, G. C. Mooring, James Bannan, N. V. Kuhlman, R. H. Johnston, and W. Clark.

Toronto No. 1 held its first meeting in Engineers' Hall, 61 Victoria street, on October 16th, President W.J. Webb presiding. William Bourne, superintendent of the Toronto Electric Light Company, gave a very interesting talk on Dynamos, Motors and their Troubles. He explained fully the different troubles that are liable to be met with in every day work, and told how to detect them and how to bridge over some of them temporarily. With the aid of the blackboard he fully explained the way to connect up different kinds of motors, which was very much appreciated by the members present. These open meetings will be held the third Wednesday of each month at 8 o'clock at the above hall during the winter months. All are welcome. The subject for the next meeting will be "The Necessity of a Lincense Law."

HAMILTON NO. 2.

At the open meeting of Hamilton No. 2 held on October 10th, the chair was occupied by president F. J. Sculthorp. About 50 persons were present. A paper on "The Metric System of Weights andMeasures" was read by James Gill, B.A., of the Collegiate Institute staff. The paper, which appears in this Department, was interesting and instructive. Mr. Gill had a chart tacked to a blackboard, and by means of these he showed the system. On motion of Ald. Pettigrew a vote of thanks was tendered to the author of the paper.

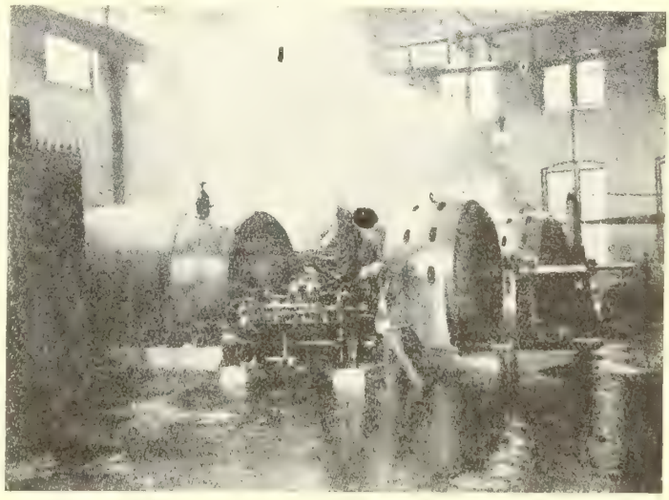
William Morris gave a very interesting talk on the machinery at the Pan-American Exposition, and the question drawer was opened and a number of questions answered by members of the Association. The meeting was a marked success and gave evidence of the benefits to be derived from the educational movement adopted by the Canadian Association of Stationary Engineers. Arrangements have been made for a series of open meetings during the winter.

GOVERNING WATERWHEELS UNDER ABNORMAL CONDITIONS.

By G. U. G. Holman.

At the conclusion of some efficiency tests on our waterwheels at the power house of the Canadian Electric Light Company, Levis, Quebec, we desired to learn how the waterwheel governors operating the waterwheel gates would work upon breaking the machine circuit at full load of the generators. This meant the sudden removal of 1,000 horse-power. The result was startling, and for the moment appeared disastrous, for one side of the bonnet of the 30-inch gate valve in the main exciter pipe to the main pipe blew out. This valve was right at the connection of the exciter pipe to the main pipe flume, which is 8 ft. 3 inches in diameter. The head at this point of connection is about 97 ft.

The governors worked very nicely, perfectly controlling the McCormick turbines, the normal speed of which is 400 revolutions. The switchboard attendant had presence of mind sufficient to pull the exciter switch and kill the machine, for at the moment it looked as though everything would be deluged with water and spray. The accompanying photograph, which fortunately one of the gentlemen present was ready and able to take, shows how the water shot up into the roof of the power house. In many ways we were extremely fortunate, the break being just within the power house wall, the blown out side of the bonnet being about 8



Effect of Suddenly Releasing Wheel Under Full Generator Load.

inches from the power house wall. The impact of the water being upwards (the bonnet being vertical), the water fortunately maintaining a vertical stream, the generators, exciters and switchboard received no water and but little spray. There was a party of 15 gentlemen present, which naturally was an encouragement to the workman, several of whom ran immediately to the head gate and closed it after a few minutes. A short circuit at ⅞ gate had occurred but a few days previously, and was likely to occur at any time in the future, so that it was well that this weak point in our system developed itself at such an opportune time.

A temporary repair was effected by clamping the broken-out bonnet side partly in place by means of 2-inch oak planks placed at each side of the bonnet, with bolts run through them, round the edge of the bonnet. Of course, a great deal of water squirted through the bad joint, and this water was forced to drop into the tail race by keeping canvas over the valve. In this way we were able to run our exciters until 3 o'clock next morning, when the water was emptied, the broken bonnet taken off, the gate removed, and on the bonnet flange of the valve a 3-inch oak plank was bolted with a thick gasket. In this way the run was continued until noon, at which time a permanent repair was effected by replacing the plank with a ½-inch boiler plate, which a machine shop nine miles away made for us on record time.

We could discover no flaw in the bonnet of this valve, and the conclusion was forced upon us that it had not originally been built with a view to the service to which it was put. I might add that the governors are Lombard.

SPARKS.

The citizens of Newcastle, N. B., are advocating the introduction of a system of street lighting.

The New Brunswick Telephone Company is planning to lay underground wires in the city of St. John, N.B.

An installation of electrical apparatus is to be installed in the new Sun Cement Works, Owen Sound, Ont.

An electric light plant will this winter be installed in the steamer Aletha, according to the Gananoque Reporter.

The Niagara, St. Catharines & Toronto Railway Company are building an addition to their power house at Merritton, Ont.

Beeton, Ont., last month carried a by-law to raise $7,000 for extending the electric light plant and for street improvements.

The promotors of the South Essex Electric Railway Company announce that a power house will be erected at Sandwich, Ont.

Surveyors are laying out a route for an electric railway between Toronto and Brockville, with a possible extension to Ottawa.

Mr. Van Dyke, of Grimsby, Ont., is said to be negotiating for the purchase of the Belleville Street Railway, his intention being to extend it to Trenton.

Ernest McAdoo, an electrician, fell from a scaffold while wiring the new building of the S. Carsley Company in Montreal, receiving serious injuries.

The town council of Almonte, Ont., have purchased a water power from Metcalf Bros., for $13,000, this power to be used for the operation of the municipal electric light plant.

It is probable that a by-law will be submitted to the ratepayers of St. Marys, Ont., at the municipal elections, to raise funds for the purpose of extending the street-lighting system.

The Montreal Street Railway Company have agreed to provide a five minute day service for the municipality of St. Louis, the price of fares to be the same as now obtain in Montreal.

Tenders have been taken for central heating, power and electric plants for the Queen's University and the School of Mining buildings at Kingston, Ont. The architects are Symons & Rae, Toronto.

The award of the arbitrators in connection with the plant of the Kingston Light, Heat and Power Company is expected to be made this month, and the by-law submitted to the ratepayers in December.

The Von Echa Company have in contemplation the building of an electric railway from Brantford to Woodstock, Ont., and have arranged for running rights over the tracks of the Brantford Street Railway Company.

The city council of Winnipeg, Man., have written to the Department of Railways and Canals at Ottawa, asking upon what terms the Government will sell to the city all the electric power to be developed at the proposed St. Andrew's locks, on the Red River.

Mr. E. C. Hawkins has resigned as manager of the White Pass and Yukon Railway, and will remove from Vancouver to Dawson City. It is understood that he is promoting the building of an electric railway from Dawson to the principal surrounding mining districts.

Electric lighting propositions are still puzzling the city council of New Westminster, B.C. The British Columbia Electric Railway Company and the Stave Lake Power Company are the rival concerns, the works of the latter company at Coquitlam Lake being in an embryo state.

The proposition to replace the present arc lighting system in Brockville, Ont., with the new enclosed arc system, is still under consideration by the light commissioners. The dynamos now in use are somewhat dillapitated, and it is believed that the installation of a new plant would be found economical.

It is the intention of the Jacques Cartier Water Power Company, of Quebec, to immediately install a steam plant, to be used as an auxiliary to their present water power plant. Plans for the proposed power house have been prepared, and it is expected to have the installation completed early in the new year.

The Montreal Street Railway Company has instituted a series of bonusous to be distributed monthly among four motormen and four conductors, only those who have a clean sheet as regards accidents and general conduct being allowed to participate. The sum is to be $10 to each prize, and the men who have the best record will participate in the drawing.

When the Duke and Duchess of Cornwall were in Brantford, Ont., the Mayor introduced to them Prof. Bell, the father of the inventor of the telephone, who presented a casket containing a silver long distance telephone, suitably inscribed.

Buffalo capitalists are reported to have purchased the Peterborough & Ashburnham Electric Railway for the sum of $150,000. The road is six miles in length and was constructed as a model by the Canadian General Electric Company. The purchasers propose extending the line to Lakefield, a distance of seven miles.

A Halifax company have secured an option on the electric light plant at North Sydney, N.S. At a public meeting the ratepayers voted down a proposal to purchase the plant for $30,000, and it is probable that it will be disposed of to the Halifax company. The new company will make improvements to the plant and extend the transmission line to Sydney Mines.

The Toronto Electric Light Company have just commenced the erection of a new office building on Adelaide street east, to cost about $30,000, the plans for which have been prepared by Messrs. Gouinlock & Baker, architects. This is the first time that an architect has been employed by the company, the capable manager, Mr. J.J. Wright, having previously taken charge of such work.

The following names appear on a notice of application for letters patent to incorporate the Manitoba Water Power Electrical Co., namely : Henry Burkholder, of Chicago, financial agent ; N. G. Leslie, of Winnipeg, bank manager : W. Georgeson, of Winnipeg, merchant ; W. W. McMillan, of Winnipeg, grain dealer ; I. M. Ross, of Winnipeg, contractor ; H. Cooper, of Winnipeg, financial agent.

The Dominion Coal Company, of Sydney, N.S., has decided upon the use of electricity instead of steam on the Old Sydney and Reserve Railway. The power house will be located at Dominion No. 2. The system will be constructed on the same model as the suburban line of the New York, New Haven and Hartford railway through Massachusetts. It is expected that the road will be completed by July next.

Members of the Quebec Board of Trade last month visited Shawinigan Falls, Que., in a body to inspect the work now in progress at that place. Over $4,000,000 has already been expended, $2,000,000 by the Shawinigan Water & Power Company and the balance by the Pittsburg Reduction Company and the Belgo-Canadian Pulp Company. Calcium carbide works are in course of construction and will commence to manufacture next fall.

Gareau vs. Montreal Street Railway was a case in which the appellant sued the company for $15,000 damages caused to her buildings, which adjoin the company's power house on Barre street, Montreal, and were claimed to have been rendered untenable on account of the smoke from the boilers and the noise and vibration caused by the machinery. The action was dismissed in the trial court, and this decision was confirmed on appeal.

The Consumers Electric Company are making good progress with the construction of their power house at the Chaudiere, Ottawa. It will be 200 feet long and 40 feet wide. The plant will consist of two generators each of 2,000 horse power, and two exciters of 250 horse power each. The water wheel plant will consist of eight turbines of 500 h.p. each. They will be arranged in two units of four wheels each, each unit being attached to a 2,000 h.p. dynamo.

The annual meeting of the Montreal Park & Island Railway Company was held early in October. The report showed the gross revenue for the year ending August 31st to have been $128,677, and the working expenses $100,096, leaving a balance of $28,561. As the interest on the bonds was $61,500, there was an actual deficit of $31,918. The following board of directors were appointed : Hon. L. J. Forget, F. W. Henshaw, Kenneth Blackwell, James Ross, F. L. Wanklyn and W. G. Ross.

The town council of Port Arthur, Ont., have awarded the contracts for the Current river power developments. For building upper power dam the contract has been given to McFarlane & Company, at $11,000. The Jenckes Machine Company, of Sherbrooke, Que., will supply the penstock and turbines, and the Bullock Electric Manufacturing Company, of Cincinnati, Ohio, the generators and electrical apparatus. It is said that there was a wide difference between the various tenders submitted.

TRANSMITTING POWER BY ELECTRICITY TO SHOP TOOLS.

A committee of one, and a very strong one, has been appointed by the Railway Master Mechanics' Association to investigate and report upon the subject of transmitting power by electricity in railway shops. This is a very seasonable subject, for while a few of our more enterprising superintendents of machinery are applying electric motors to their principal shop tools and thereby effecting a decided saving of expense, the majority are holding off for the purpose of obtaining more information concerning the value of electrical motors. We have no doubt, says Railway and Locomotive Engineering, but the report of the committee referred to will have the effect of convincing many of the doubting Thomases that electrical motors are perfectly reliable.

Meanwhile we would advise those who are anxious to adopt electric motors and are hanging off on the ropes of two opinions to read a paper on the "Influence of Electric Transmission Upon Workshop Expansion" read at the last meeting of the American Society of Mechanical Engineers.

This paper states briefly and comprehensively a number of the most important advantages of electricity as the motive power, not only where the future of the installation cannot be foretold, but where the gradual development of a plant or system of workshops may be in contemplation.

Future areas of power may be planned and arranged for with the utmost freedom and entirely irrespective of power considerations. They can be located as desired, on separate floors, in various departments or in detached buildings. Original provision for prospective development is not necessary in the electric system, but is required by shafting transmission. There is no expense for contemplated additions till they are actually installed as required.

Permanent additions to the electric generating plant and the distributing system are made with a gradual and pro rata outlay of capital, instead of in disproportionate blocks of new equipment, as required by mechanical transmission.

Extensions of electric transmission and new centers of power distribution may be established at any time and of reasonable capacity, anywhere and at any distance, at minimum cost for labor and material. There is no crowding, overloading, or interference with existing conditions, or with the daily progress of routine work. Temporary extensions to meet sudden demands for power at any point are quickly made by running to the desired location electric wires or cables. These are easily removed when no longer required and as readily used elsewhere for similar purposes. The shifts are made with the least expense of time and labor in handling, and with no accompanying waste of material to suit different conditions.

Auxiliary power is always at hand for emergencies and to almost any reasonable extent, on account of the reserve nature of the electric supply.

Mr. Thos. A. Farrell has removed into larger premises and is now comfortably located at 32 Victoria Square, Montreal. His brother, John Farrell, who is wide and favorably known, and thoroughly proficient in all branches of the trade, is now associated with him.

The Chambly Electric Company, Montreal, have purchased from Mr. Thomas A. Farrell a 250 light d.c. generator for the St. Laurent convent, Montreal.

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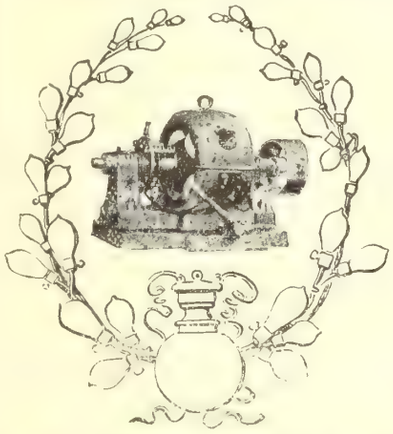
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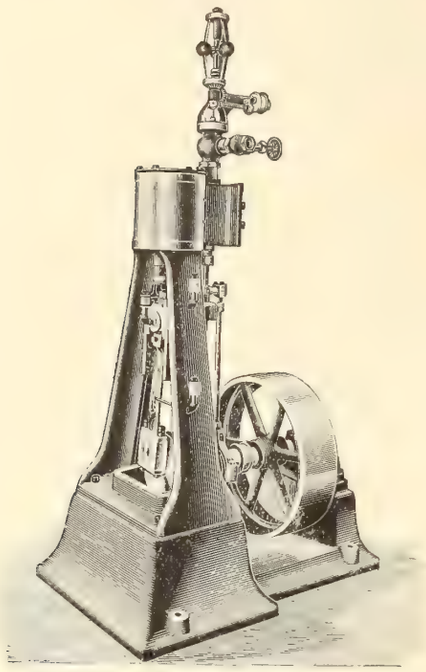
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PERSONAL.

Messrs. Robert A. Ross, E.E., of Montreal, and Henry Holgate, C.E., of Toronto, have formed a partnership as consulting and supervising engineers, with offices at 17 St. John street, Montreal, and McKinnon Building, Toronto. The new firm announce that they are in a position to undertake the complete engineering of water power developments and steam plants, electrical transmission and distribution systems and electric railways, municipal and private arbitrations and valuations, examinations and reports relating to manufacturing and other enterprises. The members of the new firm are well known, having been connected with a number of important enterprises both in Canada and abroad.

After the last board meeting of the Canadian General Electric Company, a portrait of Mr. W. R. Brock, M.P., was unveiled and hung in the board room. Mr. Brock has occupied the position of president of the company since its inception, eleven years ago. In presenting the portrait the first vice-president, Mr. H. P. Dwight, spoke of the high esteem in which Mr. Brock is held and of his business ability, and pointed out that the directors of the Canadian General Electric Company had reason to feel gratified with the results which had been obtained. Mr. Brock in replying spoke of the harmony that had always prevailed and of the loyal support of the directors.

PUBLICATIONS.

What will no doubt be found a very useful book is Shepardson's "Electrical Catechism," published by the American Electrician Company, 120 Liberty street, New York, and offered for sale at the price of $2.00. It is a revision and enlargement of the Electrical Catechism which has appeared regularly since 1895 in Electrical Industries and its successor, the American Electrician. It is intended to explain the numerous questions that continually come up in connection with the application of electricity, and should be very helpful to electrical workmen, dynamo tenders, wiremen, motormen, mechanics in repair shops, etc. It contains over 400 pages, profusely illustrated.

Attention is called to the advertisement of Farquhar Bros., Halifax, N.S., contractors and dealers in electrical supplies. This firm is now in a position to install and equip complete lighting plants, and makes a specialty of arc and incandescent lighting for private and public buildings.

The Mica Boiler-Covering Company, Limited, Montreal, Que., are now filling a large order for mica boiler and pipe covering for the British Admiralty. This firm also received the only gold medal awarded a private exhibitor in the Ontario section and one of the three awarded to the Ontario mineral collection at the recent Pan-American Exposition at Buffalo.

The Dodge Manufacturing Company, of Toronto, are installing two ten ton 3 motor electric travelling cranes in their new extensions to machine shops and foundry. The Dodge Company's shops now rank among the most complete and up-to-date in equipment. The recent extensions both in buildings and plant places the company in the very best position for handling their ever increasing trade in power transmission machinery.

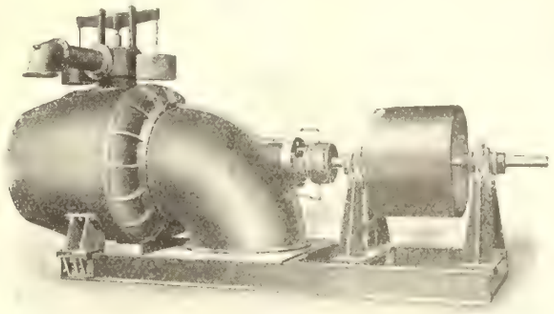
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They are now enjoying the scope of their operations and are manufacturing electrical cabs and carriages, as well as storage batteries of a durable and efficient type. The stables of the Toronto Electric Cab Company have been equipped with vehicles, to be seen in successful operation every day on the streets of Toronto, manufactured by this company. A number of carriages for private use have also been manufactured and sold.

One of the latest departures is a doctor's carriage, specially fitted with cover and adapted in every way for its purpose, the equipment including a number of small electric lamps, one of which is fitted with flexible cord and can be used to locate the numbers of houses where the street lights are not sufficiently bright for that purpose.

In their announcement in the advertisement pages of this number the company direct the attention of central station owners and others to their storage batteries and other goods in the electrical line. Mr. Norman Smith, who was for 16 years connected with the United Electric Company, has recently accepted an important position with the Canadian Motors, Limited.

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In the large and well equipped factories where the manufacture of electrical apparatus is carried out under the piece work system, they find that repair work or apparatus sent in to be repaired or rewound interferes with this system, and in many cases they would prefer not to do this kind of work, as it is almost impossible to do it with dispatch and at a reasonable price. Knowing the above to be a fact,

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The Paris authorities have submitted to the Government some fresh regulations for motor cars. A motor weighing more than 6 cwt. must have a reversing gear applied to it. If it is capable of attaining a speed exceeding 18 miles an hour, plates in front and at the back will specify it. The driver's certificate is in all cases to state the speed; in towns and villages this must not exceed 12 miles, and in the open country 18 miles per hour.

John Starr, Son & Company, Limited, Halifax, N.S., recently supplied the Dominion Iron & Steel Company, Sydney, C.B., with a large order of motors, manufactured by the Westinghouse Electric & Mfg. Company, Pittsburg, Pa., for crane and car use. The Dominion Iron & Steel Company are also installing a complete lighting plant for their marble quarry and a 100 h.p. Westinghouse motor for their calciming plant.



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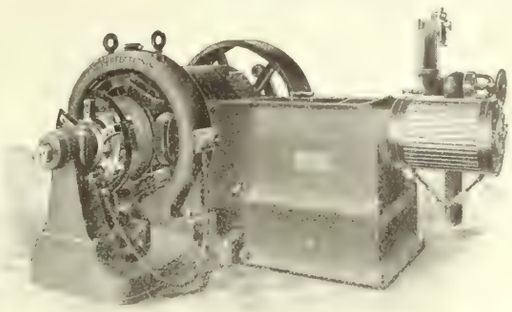
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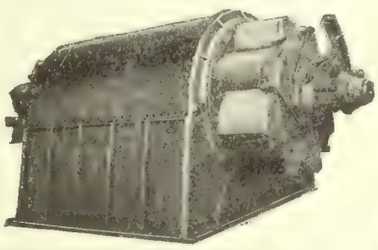
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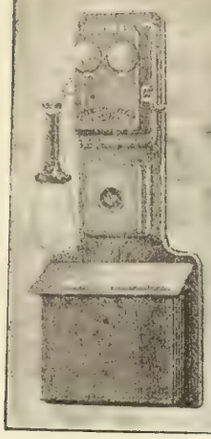
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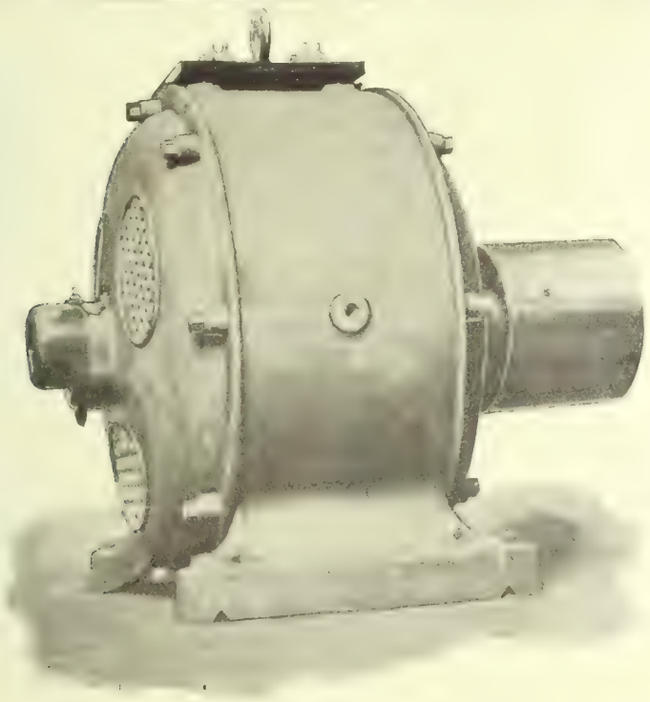
OF CANADA

CANADIAN
ELECTRICAL NEWS
AND ENGINEERING JOURNAL

OLD SERIES, VOL. XV.—No. 8
NEW SERIES, VOL. X.—No. 12

DECEMBER, 1901

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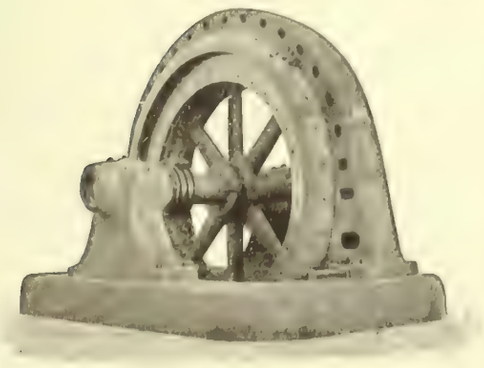
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SPARKS.

The question of installing a new dynamo for the electric light plant of Winnipeg, Man., is under consideration by the council.

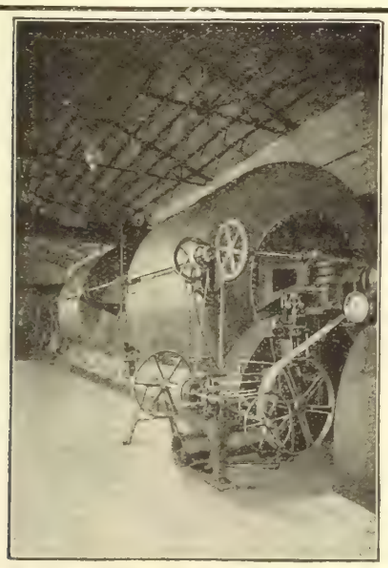
Barney Fontain, a line repairer, was electrocuted at Prescott, Ont., last month. He was working on the town electric light system and in the act of pulling up wires to make connection, when the current was turned on.

It is understood that in connection with the lighting and heating of Queens College at Kingston, Ont., Breck & Halliday are the lowest tenderers for the electrical equipment, and McKelvey & Birch for the steam plant.

Hou. E. J. Davis is installing an electric light plant in his tannery at King, Ont.

Henry Fournier broke all automobile records at New York on November 16th by going a mile in 51 4/5 seconds, using a gasoline machine. He declares that next year he will make a mile in 32 seconds.

Messrs. Thomas Pringle, R. E. T. Pringle, G. C. Rough, Geo. Leroux and Irving P. Smith are applying for incorporation as the R. E. T. Pringle Company, to take over and conduct the electrical supply business now carried on by R. E. T. Pringle, of Montreal.



PAIR OF

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Neutralizes Oils in Boiler Prevents Scale

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WRITE FOR CATALOG. DEPARTMENT E.

PERSONAL.

Mr. D. W. Robb, of the Robb Engineering Company, Amherst, N.S., has been elected Vice-President for Nova Scotia of the Canadian Manufacturers' Association.

The death occurred in Brantford, Ont., last month of Mr. Hoyt Lorimer, the joint inventor with his brother of the Lorimer automatic telephone system. Although only twenty-five years of age, he was conceded to be one of the leading electrical experts on the continent.

It is reported that Mr. Nelson Grayburn, of Montreal, is to be appointed acting manager of the Tramways Company in Alexandria, Egypt. It is also rumored that a high position in the same company has been offered to Mr. Mallison, of the Montreal Street Railway Company.

SPARKS.

The Bell Telephone Company are building a metallic line between Goderich and Stratford, Ont.

Mr. Patterson, master mechanic for the G.T.R. at Stratford, Ont., has recommended the installation of an electric light plant in the shops there.

The Hutton Electric Company and the Brampton Gas Company, of Brampton, Ont., have been incorporated, under the name of the Brampton Gas & Electric Company.

The Parrsboro Shore Telephone Company have purchased from H. C. Jenks the telephone line which he constructed between Parrsboro, Newville and River Hebert. They will extend the line to Amherst and Joggins.

The electric light plant at Elmvale, Ont., owned by Mr. Jas. Knox, of Stayner, has been sold to Mr. N. A. Ritchie, of Elmvale. A new power house is under way, in which a new 80 h.p. boiler will be installed. Mr. T. Ernest Hamilton, former manager and electrician for Mr. Knox, is in charge for Mr. Ritchie.

The Hamilton Electric Light & Cataract Power Company, of Hamilton, has entered an appeal to the Court of Appeal against an injunction granted by Mr. Justice Street restraining the company from operating a transformer station next door to Mrs. Sarah Hopkins' residence. Mrs. Hopkins claimed that the vibration was most severe, and she was given protection by the lower court.

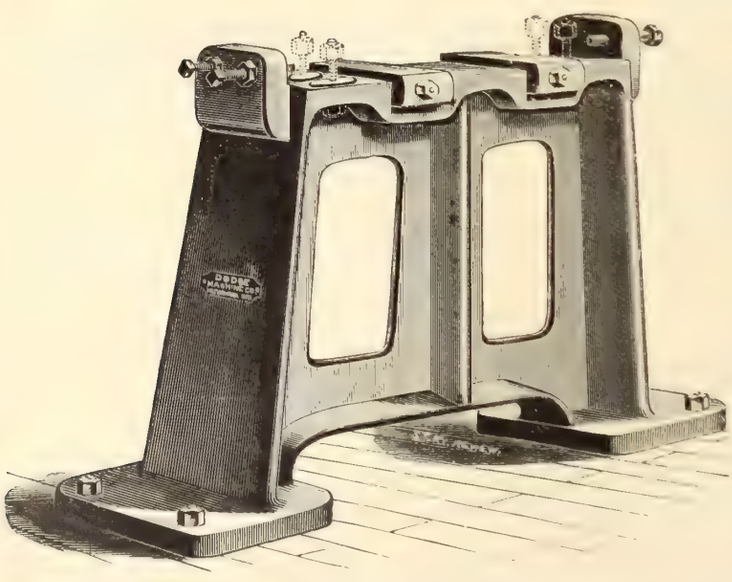
The Otonabee Power Company, of Peterborough, Ont., are actively engaged in developing the power at dam No. 5. The power house will be a substantial building, the lower course being of stone and concrete. The area of the forebay takes in two of the openings in the dam, forming a large pond from which to supply the wheels. Wheel pits will be divided for three wheels, the William Hamilton Manufacturing Company having the contract to supply these, while the electrical apparatus will be furnished by the Canadian General Electric Company.

Mr. H. J. Cloran, of Hawkesbury, Ont., has patented a device for improving navigation, by which means he says light-houses, buoys and pilots along the St. Lawrence river may be done away with. The idea is to lay a wire cable at the bottom of a navigable channel, and raise from it attached wires. To these wires are attached floats, and on them lights would be placed. If waterline lights are required these can be fastened to the floats, and if raised lights, they can be placed twenty feet up, and navigation would be maintained absolutely in the middle of the channel through a boulevard of lights from the lake to the gulf. Mr. Cloran states it is cheaper to lay lights as described than to place street lights, because there are no posts.

It is understood that the Cataract Construction Company, of Niagara Falls, N.Y., have reached the limit of their capacity, having been forbidden by the American Government to draw more water than at present from the Niagara river, on the American side. Owing to the large quantity of water used by the company it has been found necessary to dredge the harbor, which is the source of supply on the American shore. It is understood that the company have a demand for all the current which they can produce. They are now proceeding with the construction of thirty miles of canal as a part of works for the development of power on the Canadian side. The supply will be obtained between the power station of the Niagara Falls Park and River Railway and Chippewa. The immediate object of the development is to enable the company to supply power to American manufacturing concerns on the Canadian side of the river.

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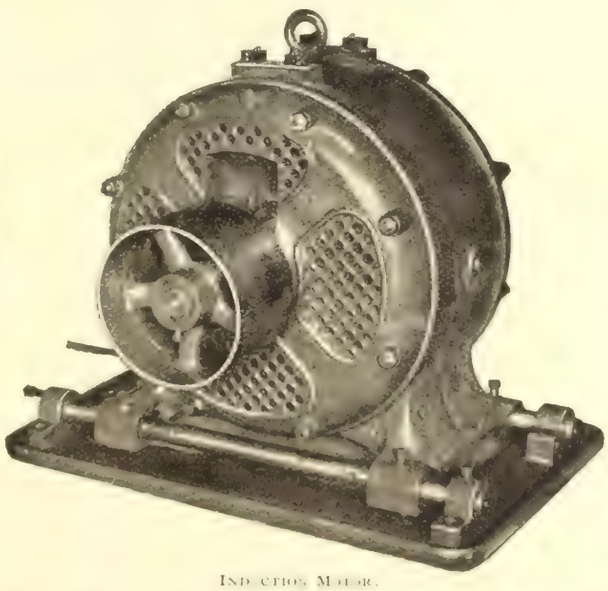
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With Absolute Cut-out.

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Electrical Apparatus and Supplies,

St. John, N.B. *Montreal, Que.*

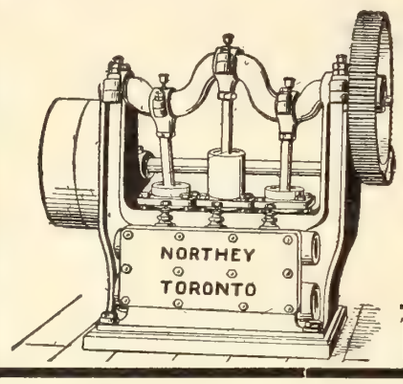
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INTERIOR CONDUIT

Iron Armoured Flexible, Metallic; also the latest article Armoured Flexible Interior Cables.

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THE NORTHEY TRIPLEX POWER PUMP



This pump excels in high class materials and workmanship. A practically constant delivery is assured by the three cranks being placed 120 degrees apart. The pump can be operated conveniently by water power—by belt from engine or by electricity.

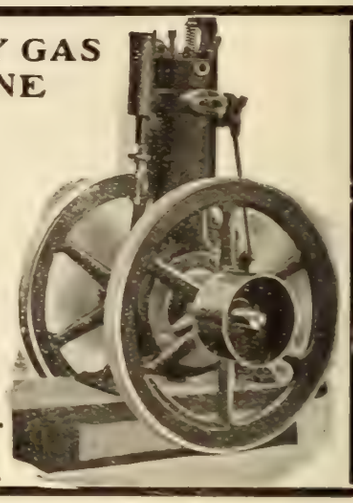
We manufacture pumps of every description—for all purposes. Our pumps are standard in Canada for excellent service.

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The Northey Gasoline Engine offers the best proposition in the market for cheap, easily handled power. The engine runs with practically no attention—any boy can manage it—running expenses very light. Ready for work on the minute. Suitable for running independent electric light plants—pumping and elevator plants, etc. This cut illustrates the ½ H.P. size—the only vertical style built, all other sizes are horizontal.

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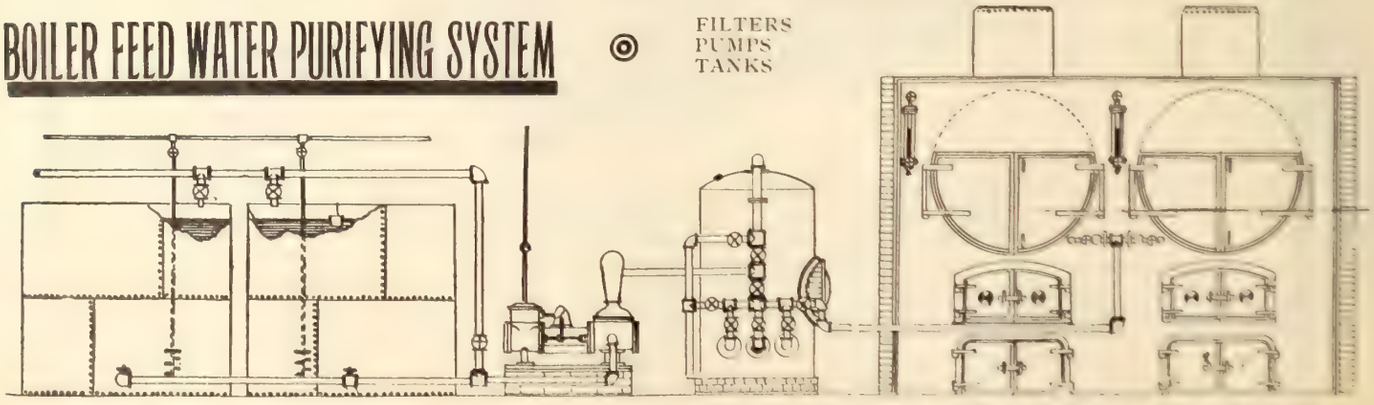
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CANADIAN
ELECTRICAL NEWS
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ENGINEERING JOURNAL.

VOL. XI. DECEMBER, 1901 NO. 12.

THE SHAWINIGAN WATER POWER DEVELOPMENT.

At Shawinigan Falls, Quebec, on October 19th, the Shawinigan Water & Power Company officially opened the power house from which current is supplied to the new aluminum plant of the Pittsburg Reduction Company. The power house, shown in the accompany illustration, is of brick, built of rubble masonry. It is 77 feet long, 74 feet wide, and 34 feet to the eaves. It contains two water wheels of 3,000 horse power capacity each, made by the Dayton Globe Works Company, of Dayton, Ohio. Two direct-current three hundred-volt generators of one thousand kilowatt capacity each are connected to each of these wheels.

The power house of the Pittsburg Reduction Company, also shown in the illustration, is located about 400 feet from the reduction works, which stand on a hill, about 175 feet above the power station. Running from the power house to the aluminum plant there is an enclosed passage way, through which aluminum conductors are strung to carry the current to the works.



SHAWINIGAN WATER AND POWER COMPANY'S STATION AND PITTSBURG REDUCTION COMPANY'S POWER HOUSE AND ALUMINUM PLANT.

The installation in the main power house of the Shawinigan Water and Power Company is not fully completed. Two generators, each of 5,000 horse power, are in place, and two of the water wheels are being installed. These water wheels are said to be the largest ever built, each having a capacity of 6,000 horse power under a head of 125 feet. They were made by the I. P. Morris Company, of Philadelphia. Provision has been made for three such units in that section of the power house now built. The second half of the station will be an exact duplicate of the first half, and thus the completed station will contain six such units, together with other required apparatus.

The water is conducted from the forebay through a steel flume nine feet in diameter. The shell of this flume has a thickness of five-sixteenths of an inch. Within a distance of 20 feet from the power house it swells to a diameter of 11 feet and changes its thickness to nine-sixteenths inch.

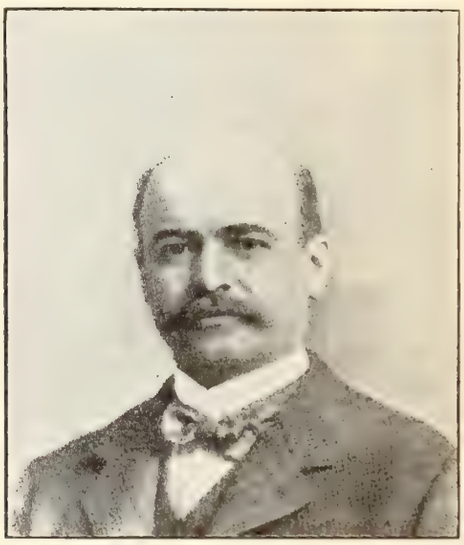
The water wheels are of the twin-turbine type. The water will enter the turbine radially from without and discharge radially toward the centre of the shaft into the draft chambers, which will connect to a single draft tube, 8 feet in diameter, swelling to 11 feet in diameter as it passes vertically down from the bottom of the casing to the tail-water, the mean low level of which will be about 25 feet below the centre of the wheel shaft. The casing is circular in form and is surmounted by two large air chambers. The total length of the water wheel from centre to centre of bearings will be thirty feet. The gate controlling the flow of water will be located in the draft chamber and will consist of two butterfly valves, side by side, closing together on the centre between their two shafts.

About half a mile from the main power station the Belgo-Canadian Pulp Company has erected a pulp mill, and this mill is to be supplied with water by the Shawinigan Water and Power Company by means of a development separate and distinct from the plants above described. The development for the operation of the pulp mill is under construction. Water will be taken out of the river about half a mile up from the canal, and discharged into the Shawinigan river, which empties into the St. Maurice river below the falls. The headworks consist of a concrete forebay, 40 feet high, and containing the racks and headgates, and these are completed. A steel penstock 12 feet in diameter is to be erected between the forebay and the mill, which is located on the bank of the lower river. In order to

put in this pipe a tunnel was excavated through the soft-clay bank about 200 feet long. Formerly this clay bank was the only barrier that kept the river from flowing down through the gorge where the pulp mill is now located. In the construction of the headworks a cofferdam 250 feet long on its face, with sides 150 feet long, extending back into the bank, was constructed, and this held the water back out of a space 250 by 150, in which the forebay walls were constructed. At the time when the cofferdam was built it was necessary to make tight against 40 feet of water on the outside, and even under these conditions the leakage was exceedingly small.

For the operation of the pulp mill of the Belgo-Canadian Company 8,000 horse power will be used, but the company is soon to build a paper and sulphite mill that will use 7,000 additional horse power.

Mr. Wallace C. Johnson, whose portrait is shown, is chief engineer of the Shawinigan Water & Power Company. Mr. Johnson is an eminent authority on hydraulics, and is well-known in connection with the development at Niagar Falls and other installations in the United States and Canada. He is a member of the American Society of Civil Engineers.



Mr. Wallace C. Johnson.

DEPRECIATION.

Business concerns, from the most modest shop to the largest railway and steamship companies, have gone into the hands of receivers from either the entire absence of, or improperly handled, depreciation account. That the subject is an intricate one, says Mr. L. S. Randolph in "Cassier's Magazine," can be readily shown by asking any given set of men what rate of depreciation should be allowed on a dynamo. One large steel works not long since built an enormous steam hammer. Three years latter it was standing idle, being thrown out by the hydraulic press; depreciation 33 per cent., the usual allowance being 3 per cent. Machines which were ten years ago the best on the market are superseded by those which will permit a competitor to double his output with half the labour; the result is that the new machines must be purchased or the business abandoned. The whole list of the various elements of cost can be gone over with the same result.

THE BELLE ISLE CABLE.

Mr. D. H. Keeley, Superintendent of Government Telegraphs, returned to Ottawa last month, having successfully completed the laying of the cable between Belle Isle and the mainland and the installation of the Marconi apparatus on the same part of the Canadian coast. This important work engaged Mr. Keeley's personal attention ever since the latter part of June. The steamship Tyrian was chartered for the cable-laying. The cable was completed on September 14th, but soon afterwards an iceburg floated down and rested on the line, where it lay in 33 fathoms of water, and severed communication. The break was, however, speedily repaired, and a few days afterwards the installation of the Marconi apparatus was commenced. Two masts 150 feet high were erected, one being placed on the western end of Belle Isle, about one mile in a northeasterly direction from the lighthouse, and the other on the mainland at Chateau Bay. The apparatus was successfully installed, and some time was devoted to making careful tests of the system and instructing the operators who will conduct the cable and wireless telegraphic system. Of these two are stationed on the inland and one at Chateau Bay. Before the superintendent left the operators, who are practical men, were able to receive and exchange signals. On the morning of the 28th of October the operator at Belle Isle exchanged signals with the Lake Champlain when the vessel was within a distance of 40 miles. A message was received from the ship and forwarded to Montreal, but the land line was unfortunately interrupted at the time and the message may not have reached its destination as promptly as it would have done had no break occurred. Nevertheless, it is a practical illustration of the benefits to the mercantile marine which may be expected from the system. The overland telegraph line extends from Quebec to Chateau Bay, a distance of about 1,840 miles.

The last link of 340 miles, between Point Eskimo and Chateau Bay, was completed this fall. Its construction was rapidly pushed in order to have it in operation concurrently with the cable between Belle Isle and the mainland. On this account the last section may need to be strengthened and rendered more substantial. The Government deserves to be congratulated on the splendid work which was so promptly carried out both in the Yukon and on the Labrador coast. By means of the cable and the telegraph the thousands of miles which intervene between Belle Isle and Dawson City have been annihilated, and the extreme east can communicate with the remote north with almost the rapidity of lightning. To carry the illustration further, one might almost say that the existing telegraph facilities enable Liverpool to communicate with Dawson City in but a few hours at most.

The Goldie & McCulloch Company, Limited, Galt, Ont., report trade good in all their lines. Besides numerous small shipments from their safe department last month they shipped a car load of vault stuff to Golden, B. C., and a car load of vault doors to one firm in Toronto. They have also orders for a car load of safes for Sydney, C. B. Other shipments include a car load of machinery for the Canada Woollen Mills Co., Waterloo, Ont.; one car load of tanks to Port Arthur; one engine to Toronto; one car machinery to Cargill, and much other small stuff.

THE LATE J. W. McRAE.

THE sudden and untimely death of Mr. J. W. McRae, which occurred on November 29th, was a great shock to the citizens of Ottawa. Deceased was cleaning a revolver in his office in the Bell Telephone Building when one of the chambers discharged, the bullet passing through his head and causing almost instant death.

Mr. McRae was held in high esteem in the community, and the warmest tributes to his worth and ability have been expressed. At the time of his death he was president of the Consumers' Electric Company and the Ottawa Transportation Company and a director of the Ottawa Land Company and the Worthwen Gold Dredging Company. He had lived a most active and useful life, and from his early days had been foremost in the advancement of industrial enterprises. In business circles he was perhaps more widely known than any other man in Ottawa.



THE LATE J. W. McRAE.

The late John William McRae was born in Renfrew, Ont., in 1848, removing to Ottawa about 35 years ago. Entering into the forwarding business, he soon became vice-president of the Ottawa & Rideau Forwarding Company, which has since been incorporated in the Ottawa Forwarding Company. He was also a leading promoter of the Ottawa Transportation Company and the Prescott Elevator Company. With electrical progress in Ottawa he was very closely identified. He was associated with the promotion and carrying to a successful issue of the Ottawa Electric Company and the Ottawa Street Railway Company, being for a time president of these companies. Only recently he successfully brought together a number of Ottawa's leading capitalists and organized the Consumers' Electric Company, a project which will likely be carried to completion at an early date. In the great fire of 1900 Mr. McRae lost heavily in the destruction of the works of the Dominion Carbide Company and the Ottawa Paper Company, which had been established but a year previous.

In his death Ottawa loses one of its most energetic and generous citizens. Sir James Grant, one of his many personal friends, says of him : " His life's work in the capital is coincident with its development in many lines of work. He never considered himself as much as he did the welfare of Ottawa and the people at large. His mental activity and physical organiation never tired when he could accomplish a good work, and his loss to the capital as well as to the Dominion is one of an irreparable character."

Mr. McRae married Miss Bell, a daughter of the late Robert Bell, first president of the Ottawa & Prescott Railway.

THE QUEBEC RAIWAY, LIGHT & POWER COMPANY.

The annual meeting of the shareholders of the Quebec Railway, Light & Power Company was held in Quebec last month. The president stated that 3,715,-675 passengers were carried during the year ended June 30th, 1901, an increase of 261,911 over the previous year. The Montmorency and St. Anne de Beaupre division carried 637,803 passengers, making a total for the whole system of 4,253,698 passengers, carried without an accident during the year. The report submitted gave general satisfaction to the shareholders.

The election of officers resulted as follows: President, A. Thomson; vice-president, Frank Ross; secretary-treasurer, Ernest F. Wurtele; manager and chief engineer, E. A. Evans, C.E.; Directors, W. Herron, Montreal; William Price, E. E. Webb, Hon. S. N. Parent, W. Shaw, George Thomson, E. N. Methot.

ELECTRICAL ILLUMINATIONS AT VICTORIA.

WE print herewith an illustration of the Provincial Government Buildings at Victoria, B. C., as they appeared when illuminated with 2,000 incandescent lamps during the visit of the Duke of Cornwall to that city. The lamps used on the end of the building were of 6 c. p., and those on the centre section 10 c. p. The main and small domes being of copper, 110 v. multiple wiring was used, while that on the stonework was connected 10 in multiple series across the 1,000 v. primary wire. The work was executed by the Hinton Electric Company, who wired up over 7,000 lights in Victoria during the Duke's visit, while their Vancouver branch installed over 5,000 in that city.



ELECTRICAL ILLUMINATIONS AT VICTORIA.

The engineering staff of the Dominion Coal Company are making a survey of the old Sydney and Louisburg railroad from Sydney, N. S., to the Reserve Mines, the intention being to construct an electric railway next year and to extend the line to Glace Bay.

CANADIAN ELECTRICAL NEWS AND ENGINEERING JOURNAL

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EDITOR'S ANNOUNCEMENTS.

Correspondence is invited upon all topics coming legitimately within the scope of this journal.

The "Canadian Electrical News" has been appointed the official pape of the Canadian Electrical Association.

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Electric Railway Development.

Electric Railway development, which was so active in Canada five or six years ago, and which of late has almost entirely ceased, shows signs of an early revival. Numerous applications have already been made to the Ontario Government for charters for the construction of new lines and the extension of existing systems. The possibilities in this direction are by no means exhausted, but on the contrary not a few openings may be found for profitable investment.

Electric Power Transmission.

THE Ontario Power Company, of Niagara Falls, is understood to be investigating the possibilities for the sale of current in the territory between the Falls and Toronto. The Cataract Power Company have, it is said, reached the limit of the capacity of their present water power development and are considering whether to construct a canal and other works which would make available additional water power, or to arrange with the Ontario Power Company to supply the required power from Niagara Falls to the company's station at Decew Falls. The works necessary to develop the increased power required would cost the company in the neighborhood of $80,000. It will probably be found more profitable to take the power from the Niagara Company. Indeed it is reported that figures have been considered which are sufficiently satisfactory to both parties to make it probable that an arrangement can be reached. The Ontario Power Company would supply the current at Decew Falls at the same voltage as is used by the Cataract Company so that it could be transmitted over the company's lines to Hamilton without change.

Experiments with the Gas Engine.

SOME new and valuable data relating to the gas engine is contained in the second report, presented recently, of a special committee of the Institution of Mechanical Engineers of Great Britain. The committee's first report, presented in 1898, referred particularly to gas engine construction, and apparatus. The present one gives the results of tests by Prof. F. W. Burstall, with a small engine constructed for the purpose. The engine was of about five h.p. indicated, 6 inch bore and 12 inch stroke, and operated at 200 r.p.m. The extreme care with which the tests were conducted is regarded as off-setting any disadvantages arising from the use of so small a machine. By using four storage cells having a capacity of 50 ampere hours, a short thick spark was obtained which never failed to give the charge during a constant use of more than two years. An improved indicator connection was also devised by which all error in the transfer of the piston motion to the indicator was eliminated. This was accomplished by the use of an oscillating quadrant with steel tape connection and with steel wires running to the indicator. The experiments show that the temperature of the mixed air and gas does not closely correspond to the jacket temperature, as has generally been assumed to be the case. Methods are described of computing the temperature for any given mixture of air and gas. By drawing adiabatic curves and comparing the temperatures and pressures, Prof. Burstall shows, as proven by the experiments, that the expansion curve should be nearly an adiabatic in order to secure maximum econ-

omy, that all the heat should be added at maximum temperature and that any after burning is detrimental. The thermal efficiency of the engine, using illuminating gas with a calorific value of about five calorics per litre, varied from 17 per cent. at the lower compression to 23 per cent. for the higher compression, the efficiency being based upou the indicated h.p., the mechanical efficiency of the engine being about 75 per cent.

Inspection of Boilers.

In the North-West Territories there is a law compelling the inspection of steam boilers and the licensing of engineers. The last report of this branch of the Department of Public Works gives some facts regarding the working of the Act which are a strong testimonial to the practicability as well as the necessity of having steam boilers regularly inspected and operated by qualified engineers. It appears that steam-users have offered little objection to the enforcement of the Act, only four prosecutions for infringement having been enforced during the year, while the majority of owners of steam plants showed every disposition to comply with the provisions of the law. If such a law is found to be workable in the North-West Territories, where there is necesarily a large number of small steam plants, it surely should be found more advantageous in the province of Ontario. The Factory Act of Ontario, as amended to cover boiler inspection, does not meet the requirements and has many weak points, there being little provision made for the carrying out of the law. One of its weakest points is that there is nothing to prevent an owner of a steam plant from being his own inspector, provided he has been engaged for five years as an engineer. Compulsory inspection of boilers and the licensing of engineers would be an advantage to both owner and engineer. There have been many instances where a boiler has been defective and unfit for operation, and both owner and tenant have refused to take any action towards replacing it by a new one. The engineer finds himself in an awkward position, and endeavors to continue to operate the boiler, even though he knows it is dangerous to do so. With government inspection, the boiler would be condemned and the owner compelled to replace it by one which would give the proper measure of safety to those engaged in the building. The amendment to the Factory Act of Ontario was a step in the right direction, and probably at the next session of the Legislature a more comprehensive and workable law will be enacted.

Power from Blast Furnace Gases.

The rapid development of iron manufacturing at various points in Canada lends importance to the success which has attended methods of utilizing profitably blast furnace gases in conjunction with the gas engine and the dynamo, for the production of power. True, the abundance of water-powers in this country, renders this method less valuable than in countries where water-power is not available, yet it might with advantage be employed where blast furnaces exist and where water-powers are scarce, as for example in Cape Breton. While water-power is acknowledged to be per se less costly, its advantage is frequently more than offset by its inaccessibility involving heavy transportation charges on raw material and manufactured product, or both. The power generating value of blast furnace gases is largely due to the electrical discoveries of Faraday, Wilde, Gramme and Werner Siemens, and to Otto and Lenoir the inventors of the cycle gas engine. A paper on this subject presented before the Iron and Steel Institute by Mr. B. H. Thwaite, A.M.I.C.E., states that to-day thousands of horse-power are being developed on the Continent by the direct combustion of blast furnace gases, and with a thermal expenditure that a few years ago would have been thought unattainable. The success has, however, not been cheaply purchased ; the production of an engine to satisfy fully the exigent demands of electric machinery driving has been secured only after the usual category of discouraging failures and costly errors ; but the history of all drastic industrial innovations is, unfortunately, alike in this respect. There is, however, the comforting assurance that the success built on remedied errors (and when the lessons from failures have been fully respected, is the most permanent. The author states that with the expenditure of some 3 to 3½ cubic metres of blast-furnace gas of a representative calorific value of, say, 106 to 122·6 cubic feet, 1 i.h.p. is developed, and a thermo-dynamic efficiency of 25 per cent. may be relied upon in every-day work, although as high a result as 30 per cent. has been recorded. One advantage of the new system, and one that has not hitherto been emphasized, is the fact that at any time desired an exact thermal expenditure in volume of gas at atmospheric temperature, to produce a given electrical energy output, can be ascertained with a refinement of accuracy to satisfy the most exigent of observers. Other advantages of the system are said to be a saving of 50 per cent. in the annual charge for depreciation as compared with a steam plant ; saving in cost of insurance due to increased risk ; and the possibility of using any kind of water. The ideal power gas for uniform and steady running is said to be one containing as combustible volumetric percentage units, some 30 per cent. of carbonic oxides and 3 per cent. of hydrogen. This condition is closely paralled by the gas ores effluent from the blast furnace. As already stated continental engine builders have been quick to appreciate the value of blast furnace gas and have succeeded in building engines of 1200 I.H.P. that are in successful operation in driving electric machinery, both continuous and polyphase, and the necessary cylical uniformity can be guaranteed.

Points in Power Transmission.

In view of what has been accomplished in the direction of electric power transmission, it is impossible to forecast the limit of development along this line, but there are one or two points which have an important bearing upon the extent of further advancement. One of these is the relation of the cost of conducting material to the price of fuel. So far it has been found profitable to employ electric power generated by a water power at a considerable distance from the point of utilization only when it is possible to obtain cheap coal. For this reason long distance transmission projects have been more numerous and successful in the far west than in the eastern sections of the United States and Canada. The price of copper, the chief material employed for transmission purposes, has within the past two months declined quite sharply. It is said that there is a heavy

over-production of this material, and that it is probable that a lower basis of value will be established for the future. Should this prove to be correct, an impetus would be given to the development of electrical power transmission schemes throughout the United States and Canada. Aluminum wire has also been found fairly satisfactory for transmission purposes. One of the longest transmission systems in California has two pole lines, one being strung with copper and the other with aluminum. It is quite probable that aluminum will also be cheaper in the near future, as the production of this metal is likely to increase after the expiration of patents controlling the methods now in use. Altogether, there is a good prospect of a reduction in the cost of conducting material in the near future.

Another point affecting the limit of long distance transmission is the break-down strength of the insulating material. It is claimed that about 60,000 volts is the limit imposed by the resisting properties of the air, as above this voltage the air seems to conduct reasonably well and leakage occurs across the line. It will very shortly be known whether this is likely to be a great drawback, as two companies in California now have pole lines which were built for a line pressure of 60,000 volts. The line of the Bay Counties Power Company is a most interesting example of electric transmission. Through its connections with the system of the Standard Electric Company, power is distributed in commercial service at a distance of 202 miles from the power house, and an arrangement is now being made to supply current temporarily a distance of 222 miles away. The voltage used is 40,000, and an experience of four months has demonstrated that extremely long distance high tension transmission service is not accompanied by great hazard because of the distance or the exceptionally high potential. A test of still greater interest was made by the Standard Electric Company, which operated one of its lines experimentally in adverse weather for over two hours at the extreme potential of 80,000 volts, and we understand without experiencing any trouble whatever.

The Bay Counties Power Company employ a novel method of driving the exciters in their power house. Exciters driven from the main generator are open to the objection that any drop in speed of the main generator causes the exciters to drop in voltage, and this in turn lowers the voltage delivered by the generator exactly at the time when, if anything, increased voltage is needed, consequently, the company adopted the following method: A 50 h.p. exciter is driven by a 50 h.p. impulse wheel. Coupled directly to the other end of the water-wheel shaft is a 50 h.p. induction motor. This motor is connected directly to the 2,400 volt bus-bars of the station. The water-wheel of the exciter is run with its valve open as for full load at all times. When less than full load is on the exciter, the induction motor acts as a generator delivering energy to the main bus-bars. If the water-wheel for any reason is interrupted on the exciter water-wheel, the induction motor drives the exciter as if nothing had happened. This method of driving exciters has been found very satisfactory, and will no doubt be followed in other water power plants.

The success of power transmission plants in California and Washington Territory is likely to bring about the employment of electric energy to transport trains over the mountains. It is understood that the management of the Great Northern Railroad has approved of the substitution of electric power for the Cascade division, which is sixty-six miles in length and includes a number of difficult grades. On this section one billion tons of coal are used annually, and it is believed that by the adoption of electric power a large saving will be effected. The Canadian Pacific Railroad Company are also looking into the question of employing electric power to carry their trains over mountainous sections in British Columbia.

QUESTIONS AND ANSWERS

The Renfrew Electric Light Company writes: Can you give us in your next issue the name of the new storage battery for McGill University referred to on page 207 of your November issue?

Ans.—The storage battery just installed in the engineering building of McGill University was supplied by the Electric Storage Battery Company, of Philadelphia. We are informed that it is a 375 k. w. hour battery, with end cell switch motor controlled.

"J. H. R.," Oxford, N. S.: Would you kindly give me the dimensions of a storage battery capable of running five 50 volt 16 candle power lamps?

Ans.—A battery to operate 5-16 c.p. 50-volt lamps for 3 hours would have the following approximate dimensions per cell, viz.: Height 10", width 4", length 5½"; for a 5-hour discharge you would use the same sized plate, but increase the number of plates per cell; this would change only the width of the latter, increasing it to say 5½ inches. For the 3-hour discharge the weight would be about 12 lbs. per cell complete; for the 5 hour, 16 lbs. To obtain 50 volts at the battery terminals when the cells are discharged down to the lowest safe point of about 1¾ volts each, would require 29 cells, and as these when fully-charged would give 58 to 60 volts, you will need either a regulating rheostat to cut down the voltage to normal, or a switch to vary the number of cells in use. You will note that this number of elements does not allow anything for drop in the wiring when the battery is discharged to the lowest safe point, and if this drop is of any appreciable amount the number of cells will have to be increased to compensate for it. The size of the complete battery when installed will vary with the relative arrangement of the cells, as it is evident they can be placed in almost any number of tiers or rows to suit the room available.

"M. W. R.": (a). I am running a Wheelock engine 14 x 28, carrying 80 pounds of steam, and making 73 revolutions per minute. Am having some trouble with the back end cut-off, as it will not trip unless I have 80 pounds of steam. I lagged the governor pulley with ¼ inch leather, and I find it gained three revolutions more per minute, but still will not trip at 75 pounds. Can you give me a remedy, or have I got too much load on? As soon as I reduce the load the valve will cut off all right. (b). Will you give me the correct

horse power of our boiler. Dimensions, length, 14 feet ; No. of tubes, 74, 3 inches in diameter ; thickness of boiler plate, ½; flue shell, ⅜; diameter of shell, 60 inches ; pressure of gauge, 80 pounds.

Ans.—(a). When the valves of an engine do not trip or cut off by the governor, but take steam throughout the full amount of the stroke allowed by the valve mechanism, it indicates that the engine is not up to the speed at which the governor takes hold of the engine, or in other words, that the load is too heavy for the engine to drive it up to that speed at which the governor will take hold. Increasing your steam pressure, leaving the load the same, or decreasing the load, leaving the steam at the same point, will both operate to make an increase of speed, which, if it goes high enough, will make the governor trip the valves. If one valve trips at a given speed, but not the other, we would judge that the setting of the valves or the cams which trip them is not quite right. They can be reset properly only by means of an indicator, or, if you do not mind a decrease in speed you can lag the shaft pulley driving the governor (not the pulley on the governor shaft), which will make both valves trip, though it would be advisable in any case to indicate the engine. (b). A boiler of these dimensions when in good condition, properly stayed and set, would be safe for a working pressure of at least 100 pounds, at which point it would be capable of furnishing steam for about a 75 h. p. engine. The reduction in pressure would not very materially affect the horse power of the boiler, though it would reduce the efficiency.

"Control" : (1) Have you any knowledge of the Lacy Auto-Controller, made by the California Electrical Works of San Francisco, or of the Excess Indicator made by the Stanley Instrument Company for the Excess Indicator Co., of Boston? One of the purposes of these devices is to effect an automatic control of a fixed maximum number or capacity of lamps for a flat rate consumer regardless of the total number or size of lamps in the installation. In working they indicate an excess over the amount of current contracted for, by causing all the lights in use to flicker until the excess is removed, when the service once more becomes uninterrupted. (2). What is your idea of the advantages or otherwise of contracts based upon maximum demands, controlled as above, for plants where maximum demand governs the cost of supply rather than K. W. hours service?

Ans.—We regret that we cannot give you any more detail information about the above instruments than that contained in your query. The principle of limiting the maximum demand to a fixed amount considerably less than the total wattage carried by the service, or, if the maximum is likely to frequently rise much above the average, basing the rate in the proportion of maximum to average, would appear to be well founded, though up to the present the question has not been taken up in Canada, except by a very few of the larger stations. The two rate meter is another instrument the gradually rising demand for which indicates the increasing recognition of the fact that power supplied during the hours of maximum load costs more and should, therefore, be sold for more than a corresponding amount furnished during the hours of minimum demand. The advantages of instruments such as you mention over recording meters, provided they were accurate and reliable, would seem to be substantial, in that they would not need reading, saving much expense in attendance and the liability of errors and disputes, and the bills for current being fixed by a flat rate, the clerical labor involved would be much lessened. Perhaps Mr. Robertson's paper read before the last meeting of the Canadian Electrical Association, and published in pamphlet form by the Association and also in the Electrical News, would be of some assistance to you in the matter.

"Ned" writes : I have an isolated electric lighting plant run from a water-wheel by a rope which is 165 feet long. The rope pulleys are single grooved and makes a riget angle turn over two idlers. The pulley on the water-wheel shaft is 58 inches and runs 180 R. P.M. The pulley in the power house is 30 inches, which would make the shafting run 345 R.P.M. The power house shafting is, of course, run by the rope, and on this shaft is the pulley to which the dynamo is belted. The questions I would like to ask are :

(a) How do you calculate the h.p. on any rope transmission, all other things known? (b) How many h.p. can I get off this particular shafting running 345 r.p.m. providing I have atightener and keep the rope good and tight? (c) How long should this rope last if it runs on an average 8 hours per day? (d) Should the rope get any dressing of any kind, if so what is good and how often should it be put on? (e) Should a rope running outside be treated differently from one running inside? (f) The rope is inch and a quarter good manilla? (g) What is a good book to read up on water power development? (h) I want to put another machine in the power house. If I can't get enough power from the single groove pulley, how would it be to put a double groove one on and use the single for a tightener close to it, and have in reality still a single rope only that the rope makes a complete wrap or turn on the power house shafting?

Ans.—Assuming that the strain on the driving side of a rope 1 inch in diameter is 200 pounds, and an equivalent value for other sizes, and that the speed runs from 1,000 to 8,000 feet per minute the h.p. is given from the following formulae :

$$\text{Horse-power} = \frac{2\ S\ (T\text{-}F)}{9000} \text{ where}$$

S = Speed in feet per minute
T = Tension on driving side of rope
F = Certifugal force in pounds.

The power of your rope, if operated under approximately the above conditions, would be about 15 h.p.; you can of course increase this considerably by running the rope at a greater tension, but this will shorten the life. A rope under average conditions will last say 3 to 8 years, the life varying very much with the conditions of operation. Dealers in rope for power transmission purposes each carry in stock dressings which they recommend for their own brand of rope, accompanied in each case by full directions for use; plumbago tallow and molasses are the principle ingredients. It is desirable to house the rope as much as possible, to protect it from the weather, steel ropes being usually installed where exposure is unavoidable. The catalogues of the various water-wheel manufacturers contain a great deal of useful information and rules covering the more common methods of developing and using water powers. For the theory and the more complex investigations consult Bovey's "Hydraulics," Unwin's "On the Development and Transmission of Power," and Kent's "Mechanical Engineer's Pocket Book." It is not practicable to wrap the rope a complete turn round either pulley in the way you propose, as you would then need a screw groove to take the rope, which would mean one of endless length, obviously an an impossibility. But you can take the rope back and over the driving pulley, and then to the one on the countershaft, reapeating it as often as you like till the necessary power is obtained. Two turns round each pulley, which means two laps of rope running side by side, give twice the power of one, three laps three times, and so on. You can also increase your power by enlarging the pulleys and thus increasing the velocity. A rope will transmit the maximum load at a speed of about 5,000 feet per minute. The pulley on your countershaft is a little too small for the best practice, it should have a diameter of about 40 times that of the rope, or say 50 to 55 inches.

THE GLASGOW CORPORATION TELEPHONE SYSTEM.

About three months ago the formal opening of the new telephone system installed by the city of Glasgow, Scotland, took place. This system is regarded as one of the most modern yet put into operation. It is constructed on what is termed the "call wire" method, which has been in operation in Glasgow for some years, and which, although not without objections, possesses exceptional merit. We are indebted to the publishers of Lightning, of London, England, for some particulars regarding the construction and operation of this system, as well as for the accompanying illustrations.

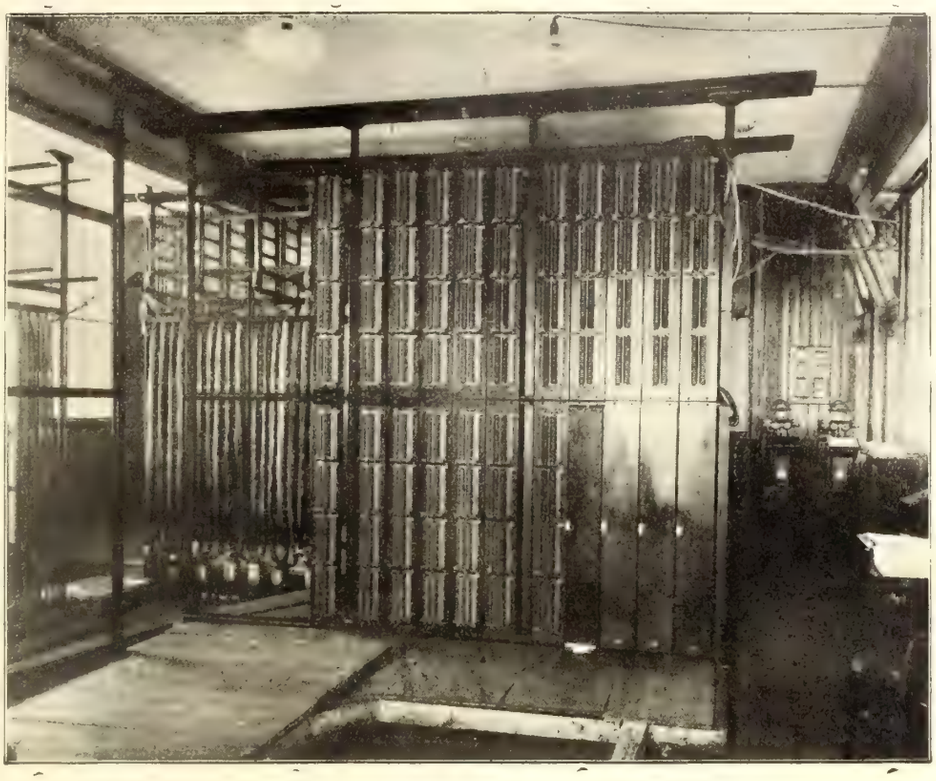
The central exchange, although capable of accommodating 12,000 subscribers, was laid out to take only 10,000 in the first instance, and a multiple board of this capacity was designed and installed by the Telegraph Manufacturing Company, of Helsby. The plugs and cords and other accessory apparatus of this board are contained in a canopy suspended so that a clear space exists between it and the board, in which the operators' hands have the freest possible play and the maximum of light is obtained, a most important consideration when small numbers have to be read and jacks selected with unerring correctness. The jacks used have only two contacts, corresponding to the two wires of the metallic loop, the test being applied through the socket with which a third division of the plug makes contact when inserted. There is no apparatus of any kind looped into the cords, so that connections when made are the most direct possible, and the chances of faults reduced to a minimum. The operators have no means of listening to conversations, so that the privacy so much sought after by subscribers is here an accomplished fact. As the corporation system is entirely composed of metallic circuits properly twisted, there is no overhearing as between line and line, and, as the operators cannot tap, the subscribers are assured against eavesdropping of every kind. There are no ringing keys. The subscribers ring each other's bells, thus distributing over the whole city work, which, if concentrated in the switchroom, would be a grievous burden to the operators and would sensibly delay the rapidity of switching. Such ringing of subscribers' bells as is necessary is accomplished by means of a magneto-generator driven by an electro-motor deriving current from the electric light mains, a branch from which is led to every operator's position and is applied by means of a plug and cord. The call wires are entirely metallic circuit. At the Exhibition switchroom, where some sixty-eight subscribers were joined up, a separate call wire was dispensed with, the calls being made by means of relays on a system devised by Messrs. Bennett & McLean. This relay system will probably be also used in the smaller outlying switchrooms of the system.



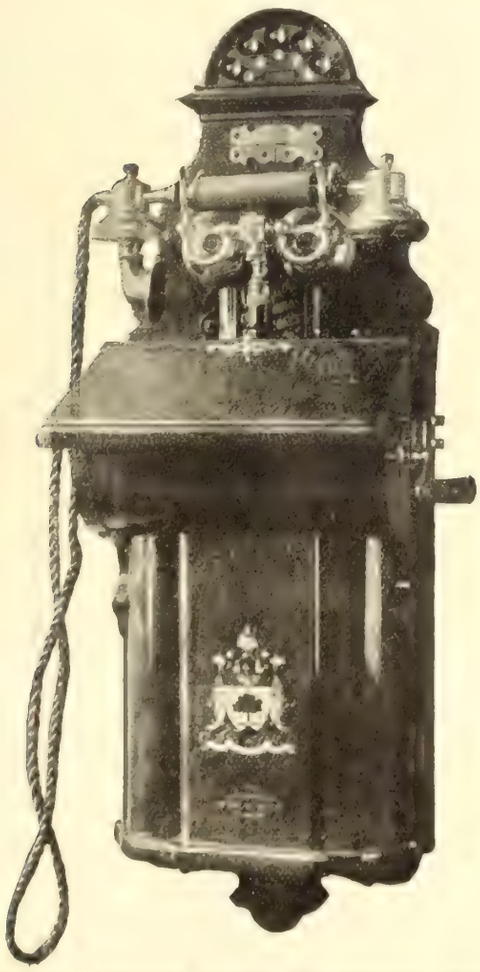
GLASGOW TELEPHONE SYSTEM—CENTRAL SWITCH-BOARD.]

The cables, by means of which the multiple board is

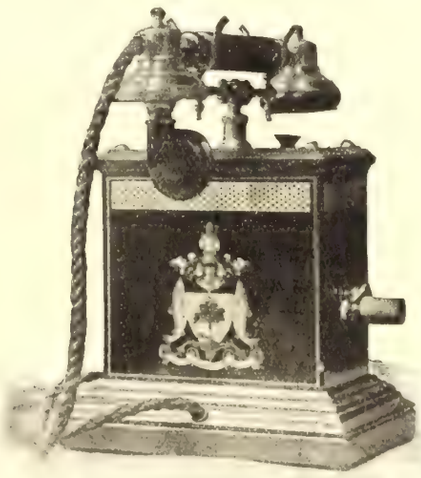
wired, are laid in an entirely novel manner. One objection to flat switchboards has hitherto been the lack of space available for cabling and the impossibility, once the interior is crammed with cables, of localizing and removing faults. At Glasgow the flooring for a few feet on each side of the table is removable and covers long troughs in which, guided by pins so that every wire occupies a predetermined position, are led the connecting cables. The branches or tails to the spring-jacks are thus alone contained in the table itself. The effect of this system is that the whole thing is accessible, and any particular cable as well as any particular pair in a cable, can be got at with greater facility than in any other description of switchboard, either flat or upright. Before reaching the switchroom every subscriber's line and every junction line is led through a carbon lighting protector, a test jack and two fuses, designed to blow at ½ ampere and to close the circuit of an alarm bell when they do so. This apparatus is duplicated at each subscriber's office, so that the system is well protected against the consequences of any contact with electric light or traction circuits. The instruments employed are of a handsome design and have been manufactured by the Ericsson-Bell Telephone Company, of Glasgow, and the General Electric Company, of London and Manchester. The transmitters are very sensitive and yield the best results when speaking over long distance trunk lines, as they are frequently called upon to do.



Glasgow Telephone System—Test Board, Showing Test Jacks, High Voltage Guards and Lightning Arresters.



Glasgow Telephone System—Ericsson-Bell Wall Instrument.



Glasgow Telephone System—Ericsson-Bell Table Instrument.

The outside work is entirely underground as regards the central districts of the city, even the subscribers' leads being taken in under the pavements. The conduits consist of 3-inch cast-iron pipes jointed with lead in the usual manner. There are many spacious manholes with ventilating covers and with trapped drain



Glasgow Telephone System. Rack for Leading Cables to Test Room.

pipes into the nearest sewer or gulley so that ventilation is secured without the drawback of flooding. The cables are of the air-space type, consisting of twisted pairs ranged in reverse layers and covered with lead. They contain from 4 to 312 pairs, the diameter of the largest being 2·75 inches. These cables, which have been manufactured and laid by the British Insulated Wire Company, of Prescot, have high insulation with low capacity. Up to a distance of half a mile from the switchroom the conductors are of No. 22 copper, over that distance they are of No. 20. Out from the centre of the city, although underground ducts and cables are employed on all the main routes, the actual distribution to subscribers' offices is effected by means of distributing poles or standards and overhead wires composed of No. 18 silicium bronze. The insulators used are of Mr. Bennett's well-known type. As a general rule creosoted poles are employed, but in certain positions square pitch pine poles are preferred, and when ornament is of any moment steel tubes, with provision for leading the cable inside them to the arms and fitted with test boxes at the base, are provided. Before the system can be regarded as complete some eight or ten other switchrooms, for most of which premises have already been taken, will require to be brought into operation.

At the date of writing about 1800 lines had been put into operation, while another 3,800 remained to be joined up.

DEVELOPMENT OF WATER POWER AT CASCADE FALLS.

This plant is situated on the main Kettle river, at Cascade City, Boundary district, B.C. The river at this point rushes through a rocky gorge in a series of rapids and falls, for a distance of about half a mile, and has a natural fall in that distance of one hundred and twenty-one feet.

For the development of the power a dam has been constructed at the head of the gorge which raises the water to a height of thirty feet above the natural level, thus giving a working head of one hundred and fifty-six feet at low water. The dam is constructed of timber cribwork filled with rock, and is forty feet thick at the base and slopes back to a width of twenty-four feet on the top. The total length of the dam is four hundred feet and the total height from the base to the top is fifty feet in the deepest part of the channel, tapering off to a height of twenty-five feet at the sides. About 10,000 cubic yards of rock were required to fill the cribwork.

The site is on a solid rock bed throughout, and the foundation timbers are firmly bolted to the rock. The permanent water level will be ten feet below the top of the dam, and provision has been made to control the water level during periods of high water by a series of sluice way, twelve in number, which can be opened down to a depth of twelve feet below the normal level. This will give an area of about two thousand square feet of waterway through which to pass the flood water. The sluiceways are closed by means of stop logs, twelve inches square, dropped one on top of the other in a groove provided for their reception. A steel rail track will be placed on top of the dam on which a travelling winch will be run over the sluiceways for the purpose of drawing up the stop logs as the water rises during floods. This winch will be operated by hand or



Glasgow Telephone System. Ornamental Post.

electrical motor. The site of the present dam was chosen with the view that at some future time a concrete masonry dam can be constructed below the present structure, and can be built without any stoppage of the plant whatever.

During the high water last June a large boom of logs, held a few hundred yards above the dam, gave way and about 1,000,000 feet of logs were thrown against the dam in a mass at a time when the water was at extreme flood, without inflicting the slightest damage on the structure. This unexpected test of the dam fully demonstrated its stability.

The water will be conveyed from the dam to the power-house, first by an open rock cut two hundred and twenty-five feet long, thence through a tunnel, twelve by fourteen feet, driven for a distance of four hundred and ten feet through solid rock, thence by another open channel for a distance of five hundred feet, to a point where a concrete bulkhead will be placed and the water conveyed in a circular flume of twelve feet diameter to the power house. About 35,000 yards of rock have been excavated from the open cuts alone. The areas of the open cuts and tunnel are so large that no appreciable loss of head will occur, and the water will enter the flume with a head equal to the level of the water in the dam.



GLASGOW TELEPHONE SYSTEM. TRENCH IN STREET.

The power-house will be placed on a natural bay at the foot of the falls, where an extensive site has been excavated out of solid rock. About 7,000 yards of rock have been removed for this purpose. The turbines will be of the horizontal type, two wheels in each case, and the generators of the three-phase alternating type. Step-up transformers will be used to raise the current for transmission. The electrical machinery is to be of the latest and most modern construction of the Westinghouse Electric Company. The power house will be a substantial fireproof structure, of brick and stone, according to the engineer's plans, 200 feet long by 45 feet wide.

A right of way has been cleared from Cascade to Phœnix, in Greenwood camp, a distance of twenty-one miles. The clearing is one hundred and thirty-two feet wide and all brush and timber has been removed. Two separate duplicate lines are being constructed of the most substantial and up-to-date description. The heaviest wire will be used and every possible means will be adopted to ensure a continuous current being maintained.

Poles are now being distributed along the right of way between Phœnix and Cascade, and all of the outside work, buildings, etc., is being completed for the early installation of the machinery at the power-house at Cascade.

The Columbia and Western R. R. Co. is putting in a side track at Cascade for the unloading of the machinery and other material, which will probably amount to more than fifty car loads before the end of the year.

BRITISH COLUMBIA TELEPHONES.

The British Columbia Telephones, Limited, which is the name under which are now registered all the telephone exchanges in the province of British Columbia, is doing a successful business as well as largely increasing the territory over which the amalgamated telephone exchanges now give service.

The directors of the British Columbia Telephones, Limited, have issued their report for the 12 months ended the 30th of June. During the period under review the profits, including the balance brought forward, amounted to £8,350. Out of this sum the directors have already paid £4,186 on account of debenture interest, preference dividend, and interim dividend on the ordinary shares, and they recommend that £2,000 be transferred to the reserve fund, making it £6,088, and that a further dividend be paid on the ordinary shares at the rate of 8 per cent. for the whole year, or the same as that paid for 1899-1900, and leaving about £787 to be carried forward.

A new line is now nearly completed to connect Victoria and Nanaimo. The board have considered it advisable to make an issue of 2,000 ordinary shares at par, to provide for these extensions and improvements. It is further stated that during the past year the profits have been adversely affected by the competition of another company working inland in the mining centres adjacent to the international border. A joint contract has now been entered into between the B.C. Telephones, Limited, and an American Company (with which this company has a reciprocal working arrangement) of the one part, and the competing company of the other part, whereby the interests of the competing company in Canadian territory will be taken over by the B.C. Telephones, Limited, and those in the United States territory by the American company.

REPORT ON ELECTROLYSIS.

The following report on the subject of electrolysis was presented to the Fire and Light Committee of the City Council of Winnipeg by Mr. F. A. Cambridge, city electrician :

WINNIPEG, Nov. 11th, 1901.

The Fire, Water and Light Committee, City of Winnipeg.

Gentlemen :—Re electrolysis testing—Acting under your instructions, I have made a large number of tests to determine the direction of current flow between the water mains and the railway system of the Winnipeg electric street railway. I have also made a careful study of the question and beg to report as follows :

THE ACTION OF ELECTROLYSIS.

As you are doubtless aware, the electric current flows out from the power house, over the trolley wires, through the cars and back to the power house by the rails. If the rail was an unbroken continuous conductor of ample size to carry the current back to the power house, we should hear very litt'e of the corrosion of water pipes, but the continuity of the rail is broken at every rail length. In the early days of electric traction the fish plate was thought ample to carry the current from rail to rail, but this was soon found inadequate. This was followed by galvanized iron bond wires, some of which were at one time used in this city ; these too were found insufficient and various forms of copper bonds were devised, all having more or less merit ; these were then followed by electric welding of the rails ; the very latest method advocated is the running of an independent ground wire between the tracks and bonding a frequent intervals.

All the bonding heretofore tried has been only partially successful, owing to the fact that the bonds are placed at the point where they receive the full force of the pounding effect of the cars passing over the rail joints. This in time causes the bond wires to loosen and in some cases break. This is the chief cause of the current leaving the rail and passing over through the earth to the gas and water pipes, for the current always takes the easiest path back to the power house.

A fortunate peculiarity of electrolytic action is the fact that the current only causes a destructive action at the points where it leaves the pipes and enters the surrounding ground. There is no corrosion where the current enters the pipes. This fact localizes most of the action in a comparatively small area.

The tendency of the current to flow one way or the other is determined by volt-meter readings taken between the hydrants and rails. These you will find attached on separate sheet. Owing to the number of additional hydrants installed, I have been able to test districts not covered by my former reports.

In addition to the action mentioned above, there is the local action at the pipe joints and local action between adjacent pipes or conductors. The former is the most difficult to deal with. As in the rail so in the pipe, the electrical continuity is broken at every pipe length by the joint. The pipes having received a coating of some sort of asphaltum, which is more or less of an insulating compound, makes it difficult to obtain a perfect electrical contact—in addition there is a certain corrosive effect set up by the lead and the iron through galvanic action between them. It has also been demonstrated that these pipe joints interpose a greater resistance to the flow of the current as their age increases. This resistance at the joints, therefore, in a pipe-carrying current, causes the current to leave the pipe at the joint, flow around the joint, either through the water inside or the earth outside, and enter the pipe again, thus producing a corrosive effect where it leaves the pipe at each joint. The other local action spoken of is where the current leaves one pipe system for another to take a shorter or easier path, or from a pipe to an underground telephone cable.

EXTENT OF AREA AFFECTED AND DAMAGE.

I have not examined any pipes, nor do I undertake to express an opinion as to the extent of the corrosive action. The Water Department have doubtless examined pipes from time to time and will be better qualified to express an opinion on this point. The Bell Telephone Company have found their underground cables affected and have taken steps to overcome the difficulty by means of connecting a large copper wire between the ends of the lead sheathing of their cables and the power house ; this has shown at times that as much as 50 amperes of current is flowing through their cables.

I can, however, say this, that the water and gas pipes in an area lying between Broadway, Osborne street, River ave., and Main street as far as York street are electrically positive to the ground and rails, and that according to well established electro-chemical laws they are in a favorable condition to be prejudicially affected by the street railway current, and further, that it is possible to overcome the danger without any great amount of expense, considering the importance of the interests involved.

MEANS OF PREVENTION AND CURE.

Various remedies have been suggested and tried in various cities, (1) Connecting the pipes to large copper conductors and draining the current off, carrying it back by overhead or underground returns to the power house ; (2) Double bonding the rails ; (3) Cross bonding between rails ; (4) Negative "boosters" at power house ; (5) Independent ground returns, culminating in (6) prohibiting the use of the earth as a ground return.

Remedy 1 is merely a palliative ; it might answer well enough in the case of a telephone cable system, owing to the absence of the pipe joint element, and if carefully watched from time to time. In the case of piping, however, while it would reduce or overcome the danger where the current was leaving the pipes, still, as it would reduce the resistance of the pipe line, so it would in the nature of the case encourage more current to flow in that system and accentuate the local troubles before mentioned. This method might be advantageous if preceded by the adoption of Nos. 2, 3 and 5. I am not aware that method 4 has ever been tried on this side of the Atlantic, though advocated in Europe; the prohibiting of the use of the ground return and the substitution of the double trolley system is not to be viewed with favor, and the dangers of the overhead construction might be greater than the electrolytical.

In making an examination as to the local methods of carrying current back to the power house, I find that almost entire dependence is placed on single bonding between each rail. I have found in a partial examination of tracks on unpaved streets that a number of these bonds are loose. I am informed that it is frequently found that bonds become loose and are broken on paved streets. In addition there is a return feeder connected to the rails at the south side of Main street bridge, also another return feeder on Main street connected to the rails at the following points :—Broadway, Portage Ave., William Ave., Logan Ave., and Main and Sutherland streets. There are four outgoing feeders, so that you can see that a great deal of dependence is placed on the rail return. A greatly improved system of bonding is being put in by the company at the entrance to the new car sheds. As I have pointed out, there are methods of overcoming the electrolytical danger without incurring an alarming outlay. It should be possible to reach the desired results in a friendly spirit, and once the results desired are reached, continual watchfulness as to the electrical condition of the water mains, followed if necessary by further extension of the return system, will, I believe, keep things right.

Your obedient servant,

F. A. CAMBRIDGE,
City Electrician.

WIRELESS TELEPHONY.

Wireless telephony will in the future play a very important part in all matters connected with navigation and warfare. In this connection the utility of the "Singing Bow Lamp" has been theoretically and practically demonstrated by Dr. Sim, a Frankfort physicist. Huge reflectors, with "Bow-lights" of a total power of 40,000,000 candles, are already being used, and as they are movable can be concentrated on any fixed point at a distance of many miles. Whenever a selenium cell is struck by the luminous cone in which all the rays of such a reflector are united, the telephone apparatus is set in motion—the luminous cone acting as a conductor—the selenium call receives like a micraphone and the telephone begins to talk. At the Berlin Fire Brigade Exhibition a selenium cell has been suspended at one end of the hall in a small wooden case, and a "Bow Lamp" with a small reflector at the other end. All the bells in a large clock tower near the hall ring, and an incandescent lamp glow whenever the light of the reflector is turned on the selenium cell. The great advantages claimed for wireless telephony is the ease with which the light can be deflected to any point, but nothing is said about the effects of certain atmospheric conditions in curtailing the range of the light.

ENGINEERING and MECHANICS

CANADIAN ASSOCIATION OF STATIONARY ENGINEERS.

BANQUET OF TORONTO NO. 1.

The annual banquet of Toronto No. 1, which took place at the Walker House on Thanksgiving Eve, was fraught with quite as much interest as any of its fourteen predecessors. About one hundred and seventy-five persons were present. As president of the Association, Mr. W. J. Webb occupied the chair, while near him were seated Ald. Frame, representing the City Council; Charles Moseley, executive president; J. Litster, manager Pure Gold Manufacturing Company; W. Campbell, manager Reeves Pulley Co; J. J. Main, of the Canadian Heine Boiler Company; A. M. Wickens, executive secretary; Alex. McRae, chief engineer water-works; John Galt, C. E., Dr. Orr, A. E. Edkins and O. P. St. John, inspectors for the Boiler Inspection & Insurance Company. The usual good menu was served and apparently thoroughly enjoyed. Letters of regret were read from His Worship The Mayor, Ald. Woods and City Engineer Rust, who, owing to other engagements, were prevented from being present.



MR. W. J. WEBB, President Toronto No. 1.

The president, in his opening remarks, spoke of the success of the Association as evidenced by the large number present, and as toast-master asked the assembly to rise and drink the toast of "The King," which was honored by the singing of the National Anthem. The second toast was "Ontario, the Banner Province," a response being given by singing "The Maple Leaf." To "Toronto, the Queen City," Ald. Frame responded. He congratulated the Association upon its efforts in the direction of education, and said they should feel gratified that so few complaints were made against the engineers in the city of Toronto.

Coupled with the toast of "Our Guests" were the names of T. Elliott, of Hamilton, President of the Ontario Association; Alex. McRae, water-works engineer; J. Ironsides, secretary of the Hamilton association; and O. P. St. John, of the Marine Engineers Association. Mr. Elliott said that he hoped Hamilton No. 2 would soon fall in line and hold annual banquets. He referred to the advantages of the Ontario Association working in harmony with the Canadian Association with a view to securing a proper license law. If the Government did not enact such a law they would be criminally negligent of their duties. Some thought that it would be a hardship to owners of small plants, but he did not think so, as this could be overcome by having grades of certificates, as was done with marine engineers. The small boat owners had not found the Marine Engineers Act a hardship. Mr. St. John said that he was much interested in the efforts of the different societies to secure a law requiring the licensing of engineers and inspection of boilers. He pointed out some of the weak points of the Factory Act, one of which was that an owner may inspect his own boiler if he has been an engineer for five years. No machinery had been provided to put the Act in force, but he hoped that very soon an Act properly covering the ground would be put in force. The recent Detroit explosion, when some twenty lives were killed, was the second one in six years in that city, and should be an object lesson to manufacturers of the necessity of legislation and inspection. His experience was that large manufacturers were just as much opposed to a license law as the owners of small plants.

Responding to "Our Manufacturers", Mr. J. Litster, manager of the Pure Gold Manufacturing Company, expressed his sympathy with the compulsory licensing of engineers. A member of the Association was employed by his company to operate their steam plant, and he did not think that manufacturers should offer any opposition to the legislation that had been asked for. Mr. Campbell, of the Reeves Pulley Company, pleading inability as an orator, asked permission to give a musical recitation, which was very much appreciated. Mr. J. M. Sinclair, of the Eureka Mineral Wool Company, spoke of the progress of manufacturing in Canada and of the advantages of mutual good feeling between employers and employees, instancing one or two cases where employees had demanded increased wages notwithstanding that the head of the establishment was drawing upon his private bank account to keep the business running. When Mr. J. J Main rose to respond to the same toast he was greeted with shouts for a story, and after acquitting himself in this direction, gave some advice to engineers, urging them not to endeavor to do the bricklaying and such other work around a boiler room, but to aim to excel as engineers. He called to mind some remarks regarding a defective boiler that had been made by him at one of the engineers' banquets a few years ago, and stated that he had since learned that the boiler in the basement of the building in which he was then speaking was in an equally bad condition, and he had taken it out within the past month. He described the different methods which had been taken by the engineer to repair the boiler, one of which was the driving of wooden spikes in the top of the boiler. He said that if the government could only realize what he did they would immediately pass a compulsory law.

In responding to the toast of "Our Educational Interests," Mr. John Galt gave an interesting talk on technical education and congratulated the Association in having taken the first steps to introduce technical education in Toronto. As to a license law, he thought the city of Toronto should make a beginning by passing a by-law that when a boiler is installed a certificate of its perfect condition shall be given. Dr. Orr and Mr. A. E. Edkins also replied to this toast. After the toast of "The Executive," to which Messrs. Charles Moseley, G. C. Mooring and A. E. Edkins responded, Mr. J. Ironsides in a few words proposed the health of Toronto No. 1, to which the President, Mr. Webb, responded. Songs were contributed during the evening by Messrs. Blackgrove, Brown, Anderson and Gray. The committee in charge of the arrangements for the dinner included H. E. Terry, chairman; James Bannan, secretary; W. J. Webb, G. C. Mooring, A. N. Wickens, M. V. Kuhlman, W. Clark, W. N. Outhwaite and R. H. Johnston.

REASONS WHY ENGINEERS SHOULD SUPPORT A LICENSE LAW.

By A. M. WICKENS.

Laws are made in all civilized countries for the safety, the convenience, and benefit of the inhabitants, and are usually such that the interests of all are conserved. Sometimes the interests of people in different walks of life are so divergent that it seems impossible to frame a law to suit all the requirements it is intended to cover. In cases of that kind the particular parties or factions of the people having the most influence succeed in having the law framed in such a way that it is to their peculiar and personal advantage.

All laws that are proposed for the improvement, and advancement of the artizans and working people, are looked upon as reforms of such a liberal character that it sometimes takes years of work to have one of them placed upon the statute books of the country. Antagonistic feeling between the laborer and the capitalist is gradually being removed, consequently needed re-

*Paper read before Toronto No 1 C.A.S.E.

forms are more easily procured than they were 30 or 40 years ago. All reforms bring out strong opposition, and the anti-reforme is always on deck. If you kept a store on any street, in a city, town or village, and wanted to sell gunpowder, you would come under the restriction of the law, and you would not be allowed to keep it except in very small quantities at your place of business. If you had a keg of it you would be required to store it in some isolated place. This is because it is explosive and is considered a dangerous article in the eyes of the law. Now, gunpowder never goes off of itself, it takes a spark of fire to ignite it, and if you do not supply the spark you will not get an explosion. This law seems to be satisfactory to all; we do not hear complaints about it. The same storekeeper can put a steam boiler under his store and fire it up any way he likes, or put it in charge of a man or boy who knows nothing about it. There is no law to regulate him in this matter, still his relation to his employees, his customers and his neighbors is just the same as it would be if he had a one hundred pound keg of powder with the spark right close by all the time.

One of our ordinary return tubular boilers rated at 60 h. p. with a pressure of 80 pounds per square inch, has a greater explosive power than 100 pounds of gunpowder, and the risk is there all the time. We have the pressure up all day and the fire to keep it up—in reality the use of a boiler needs regulating by law more than the sale of gunpowder does. If you wish to practice medicine you must first have a diploma or certificate of competency and very rightly so, because human life will often depend upon your knowledge and skill. The law concerning doctors creates them into a close corporation (this is a case where influence with government is clear), and you must go before a tribunal of other doctors for examination. This leaves them masters of the situation, because if there are too many doctors in practice they can raise the standard so high that only a few can pass, by this means keeping the number of would-be doctors down to a minimum; supply and demand regulate the price of everything, and if the supply of doctors is low, the prices for their services keep up The dentists also have a law upon the same lines as the doctors. This must seem strange to you, as it is almost an unknown thing for accident or death to occur while under the operation of having a tooth pulled. The lawyers, too, of this great free and enlightened country have a close corporation. To become a legal light it is necessary to pass the bar of their own examination. This is another case where legislation was not enacted for the benefit of the whole people, and a case that did not need regulating by law for the safety of life, limb or property.

You may ask what has all this to do with an engineer's license law. It is this, there are thousands of boilers in this province situated in buildings teeming with people, and everyone of these boilers, under certain conditions, will surely blow up, wrecking property, killing and maiming persons in the building, and even doing the same to people who are some distance away. Time was when boiler explosions were looked upon as unavoidable. Various ideas were set forth as reasons why ; among them that some unknown agency was at work within the boiler, or that under certain unknown conditions an explosive gas was formed of such terriffic power that no boiler could withstand it. In later years the researches and experiments of our leading engineers have proved the fallacy of all such ideas, first, by learning the principles of the expansion of water into steam, then by studying the chemistry of heat, of coal, and of iron or steel, and lastly by arriving at means by which to measure the strength of material. The intelligent engineer after studying all these things gives up the idea that boiler explosions are accidents—he knows that a boiler only bursts when the internal pressure is too great for the strength of the material of which the boiler is made.

Present day methods of making and testing boiler plate, whether of steel or iron, are such that we are reasonably sure of the strength, and the same reasons show us the full strength of the completed boiler. We can test the strength of different kinds of workmanship and can compute the bursting strength of any new boiler, consequently we are able to operate them in perfect safety while they are new. However, in use boilers are subject to the strains of pressure and the movement of the material in expansion and contraction, and from the first begin slowly to get weaker, and after they have been in use for some years it becomes more difficult to fix upon the safe working pressure, but even this may be done by trained inspectors. If the records and reports of the various boiler insurance and inspection companies are carefully examined, ample proof can be found to substantiate the statement that boiler explosions are not accidents. Take the records of the Canadian Steam Boiler Inspection and Insurance Company, who have during the last 24 years inspected several thousands of boilers with a result that they have not had an explosion that occasioned loss of life. They have had, however, several ruptures, but even these have occurred only when the regulations and directions of the company have been neglected or not complied with. Viewed from any standpoint the inspection of boilers by trained men has proved to be of great value to steam boiler owners, operators and their neighbors.

You may ask what has all this to do with licensing engineers? It is this, the results prove that inspection by the right kind of men is first of all safe ; secondly, it pays the owners in saving them lost time, in saving costs for extensive repairs, and in the security they are getting from having this work regularly and thoroughly done. A man to become a successful boiler inspector must aim at a high standard of knowledge and ability, or he never can succeed in his business. This brings us to one very good reason why stationary engineers should have a license law—it would raise the standard of ability to become an engineer. We have too many men in the business to-day that aim at nothing—and hit it. I do not propose to say that a license law would create any great advance in wages for engineers. It did not do so in the case of the steamboat engineers, when their present law came into force. Wages cannot be regulated by law; there are three things which conjointly regulate wages, viz., supply, demand, and ability. Many men are working 12 hours per day 6 days per week, and on the 7th washing out boilers, for about $9 per week. The vital question for us is why is it so. The principal reason is that about $9 per week is the worth of the ability carried under the cap of the so-called engineer. To earn more, learn more; the man who knows more gets better pay every time. Why? Because he can give his employer more steam from one pound of coal; because he can keep his engine going at a fixed rate of speed all day; because he has no shut-downs during running hours; because his repair account is kept down to a minimum; because he looks after the little heat wastes, and in fact is worth more to his employer, and all this perhaps without half the hard work and worry that falls to the lot of his poorly informed brother engineer.

A great advantage to every engineer under license law is that he has something better in view—a goal to reach; this would make him more careful of his time, he would spend part of the money he fools away now for his own improvement and knowledge, he would dress better and and he would feel more manly in the world.

The advantage to the employer would be that he would be better served, he and his engineer would be nearer together, and in consultation could reduce fixed working expenses. He would have also the satisfaction that he had filled the requirements of the law, and had taken the best precaution at hand for the safety of his employees and his neighbors, and that the safety and efficiency of his boilers were fully taken care of. There are engineers who are opposed to any kind of license law, and who always work against the passing of any kind of legislation. If you approach them about it they give various reasons for their action, but no matter what reason they give or how many reasons they set forth, it always comes out that they are afraid they cannot pass the examination. One will say book learning is no good, or that he never had no chance, because he never got any schooling, or that it is only engineers with swelled heads that ask for a license law; there are other stock reasons given, but if you follow them all up you find it is the fear that they cannot get such a certificate as they think they ought to have that makes them oppose the measure.

Now, it is not expected a man will need to study mathematics, chemistry, physics and electricity in order to fit himself to shovel coal into a boiler furnace, or to start, stop, oil and wipe the grease from an engine, and to be told what to do by the foreman who knows nothing about engines or boilers. What does any man work or study for? If you were doomed to solitary exile for the rest of your life you would make no effort to become wise or well-to-do in this world—just the bare necessities of life would satisfy you. Some men act as though they were in exile now, and because they barely get the necessities of life for themselves, would hold all others down to the same level if they could.

Any man who is running a boiler and engine should not be afraid of a practical examination unless he knows nothing about

the business, and if he is so ignorant, he should be in some walk of life where his ignorance would not be a menace to his fellow beings. If he knows how to do it he certainly should be able to tell how it is done, whether he ever had any schooling or not. If a man does not know how a safety valve is constructed and how to take care of one, it would be no use for him to know how to figure out a safety valve problem. A man would not need a very high order of education to tell what he would do if he came into his boiler room at ten minutes to one o'clock and found 150 pounds gauge pressure upon the boiler when his safety value was set to blow off at 70 pounds, or if his feed water pump was in trouble he would not need mathematics to tell what action he should take to start it up again—in fact, the whole of a practical examination has nothing to do with a man's ability as a scholar, but the man who is a scholar will learn these things in half the time the unlettered man can. Engineers' license laws have been enacted in many places and countries. Steam vessels sailing under every flag carry licensed engineers, while the stationary engineer in all the American cities and in the states of Massachusetts, Ohio, Minnesota, Dakota and Kansas have to pass an examination. In Canada we have Quebec, the North-west Territories, and British Columbia in line. Manitoba has a boiler inspection law, and in Ontario the Factories Act has been amended so that the boiler comes under the factory inspectors, but the machinery to carry out the law is defective. The official report of the North-west Territories for 1900 says that there were 509 steam boilers inspected, 141 examinations of engineers, first-class certificates 7, second-class 78, third-class 74, provisional 178, and permits 42, making a total of 379 engineers. This was an increase of 120 boilers over the year before and a decrease of provisional certificates to the number of 126, thus showing that the men either went out of the business or passed the examination for a higher grade. The report says a very large percentage of the owners say it is very desirable to have their boilers inspected, and properly qualified men to operate them. The fees collected from the owners were $2,430 for inspections, and the fees from engineers for certificates amounted to $1,140, thus making $3,570. This was a source of income to the government. There were four prosecutions under the act for infringement of the law. I earnestly hope we may be able in the near future to say that the banner province of Ontario has also a first-class license and inspection law.

THE CHEMISTRY OF SOME COMMON THINGS SALT AND VINEGAR.

At an open meeting of Hamilton No. 2, C.A.S.E., on November 14th, Mr. Williams, chemist for Winer & Company, wholesale druggists, gave a very entertaining address before a fair sized audience of engineers and their friends. The chair was occupied by the president, who introduced Mr. Williams in a short speech. The speaker throughout illustrated his remarks with a number of chemical tests, which in addition to intensifying the interest, assisted in a material manner to convince the audience of the truth of the speaker's remarks.

"These two substances," said the speaker, "will form good examples of common things, common from time immemorial, for these two substances we use so freely now are contemporary with man. Through the vast stretch of time which lies between us and early man, this substance, which we will examine, taste, and analyze, has had the same use and been of the same benefit to the race. Salt has been a medicine, a condiment, a token of exchange, a badge of convenant, and to-day it is one of the great items of commerce, the output yearly of Great Britain being in the neighborhood of 2,000,000 tons. Man in all probability found salt by trying to heal his wounds and sores, and he found that though it stung him, the wound healed, and by the use of this earth would give him less trouble. And so with many other things which man found to be good for use, salt became a great necessity. Hence we find it at different stages in history ranking with gold and other precious things."

"Salt is found on the land and in the sea, and from both these sources it was and is obtained. People inland found it encrusting the earth and gathered the mixture of earth and salt, and this probably accounts for the seeming contradiction in the words 'the salt has lost its savor.' Heating the piece of rock salt in the flame until almost red hot, we find it unchanged. We find the explanation in this, that the people of that day used this earth-mixed salt, and if the salt became dissolved out of the earth, which apparently did sometimes occur, then this so-called salt had lost its savor. We examine these samples of salt and we find them exhibiting the same characteristics, and though they may have come from sources far apart, we find them to be really the same substance. Coming now to the chemistry of this substance, we find it to be composed of two elements, chlorine and sodium, a gas and a metal. We have observed before that matter is composed of a certain number of substances, mixed and blended, some in larger proportions, some in smaller. We find these elements in the form of gases, liquids and solids. The solids we find are the metals with which we are familiar, iron, copper, etc., and sodium, a metal even softer than lead. It can be rolled like putty. It is so easily oxidized that it has to be preserved in coal oil. It combines with the oxygen of water with such energy that it inflames the hydrogen, sets it free and apparently the water is on fire."

"Chlorine, the gas which combines with this metal sodium forming salt, is the main constitutent of hydrochloric acid. We can make salt by combining these two elements, by mixing hydrochloric acid, which will give chlorine, and some caustic soda, which is sodium metal combined with the elements of water. Let us trace the chlorine and sodium, and we must remember that matter being indestructible, the balance of the hydrochloric acid and the balance of the caustic of sodium, after the chlorine and sodium have formed salt, are not lost or dissipated. We take these elements which are left, and knowing that hydrochloric acid is a compound of hydrogen and chlorine and caustic soda a mixture of sodium and hydrogen and oxygen, we then find these two latter elements of water, hence we have salt and water."

The speaker at this point put the salt and water he had made to severe chemical tests, which proved that what he had produced was really salt mixed with water.

"The substance, vinegar, is equally ancient," said Mr. Williams. "Man in all probability experimented with the sour stuff he found to result from the fermentation of the fruit which he had laid aside. Finally, some curious mind, observing that this spoiled fruit could corrode metals with which it came in contact, tried this sour stuff as a medicine. Any saccharine substance in solution of water, if diluted and exposed to the air, will ferment and sour, and vinegar is formed."

"All alcoholic fluids can be used to make vinegar by diluting with water and exposure to the air, by which oxygen is absorbed and the alcohol becomes an acid. Acetic acid is obtained by another very different process, but all acetic acid is similar. This acid is obtained by distillation from hard wood, kept out of contact with the air, as is done in the smoke house, with the formation of dense tarry smoke. This smoke is composed of creosote, which is a substance for which the smoke house exists and which preserves the meat which is hung there, and water charged with various substances, among which principally is acetic acid. Very large quantities of acetic acid are made in this way, and by treatment with alkalies and acids this tarry acid can be converted into bright sharp acids, from which many chemicals can be prepared for use in art and medicine.

"We thus see that some of these substances called acetates are a compound of this acid and some of the metals we have referred to. You have all seen the corrosion which occurs in smoky stove pipes where the draught is faulty, and you have also seen the liquid which drops from these corroded pipes. This is acetic acid, formed from the incomplete combustion of the wood in your stove or furnace, and the liquid is acetate of iron, and the black stain made on the floor is the acetate of iron and the tannium in the wood forming ink. Vinegar made from acetic acid lacks the odor and flavor of what may be called natural vinegar."

Mr. Williams, in answer to a question as to the source of salt, said that he traced the elements of it as it came; a part of the huge fireball of which the earth once was, fused oxides and hydrates, acting and reacting on each other as they lay side by side, only to be heaved again and again, until the hydrogen of the hydrates and the oxygen of the oxides parted to reunite as water vapor; this condensing in the high attitudes, caught by the tips of the mountains, running down their hot sides only to act on hot oxides and to be thrown again and again in hot vapor, again to descend until succeeding ages brought pools; pools became seas, and seas became oceans, and salt was dissolved. The sea was salt, oceans were dried up, and the earth had mines of salt, and thus were they made together. The earth gave the sea its salt and the sea gave the earth its salt.

TRADE NOTES.

The Wire & Cable Company, of Montreal, have ordered a 300 horse power compound engine from the Robb Engineering Company, Amherst, N.S.

The Electrical Construction Company, of London, Ont., have installed a lighting plant in the St. Laurent Convent, St. Laurent, Que., also one for the Dowsley Spring & Axle Company, Chatham, Ont.

The Robb Engineering Company, Amherst, have received an order, through Ahearn & Soper, Ottawa, for a 40 horse-power engine for the Dominion Arsenal, Quebec.

The Jenckes Machine Company, of Sherbrooke, Que., have just issued a new 142-page catalogue of hoisting engines and mining machinery manufactured and supplied by them. It is a most complete work, containing many useful tables and excellent illustrations and a price list of the various lines of goods which they supply, including mining machinery, steam engines and boilers, turbines, saw mill machinery, etc. The company will be pleased to send a copy of the catalogue to any of our readers who may be interested.

The Blenheim "News" of November 7th, 1901, after noting the objection to the payment of various accounts, in its report of the Town Council meeting says: "A pleasant change was the prompt manner in which the Goldie & McCulloch Co.'s account of $2,829.50 for boiler, engine and fittings was passed; amid words of highest commendation by all the members for the manner in which that firm had carried out their contract. On motion it was decided to tender them a vote of thanks for the manner in which they had done their work.

The Dodge Manufacturing Company, of Toronto, Limited, have recently completed very substantial extensions in the way of new modern machine shops and foundry, also a very handsome two storey office building for general offices and draughting rooms. Both shops are equipped with 10 ton 3 motor electric travelling cranes. The machine shop is equipped with very heavy tools of latest design and the foundry with all the most modern ideas in foundry equipment. The Dodge Company are now taking care of all kinds of foundry and machine shop work, no matter how large, and are undertaking early deliveries. Power transmission machinery is their specialty, a 260 page catalogue descriptive of which is mailed on application.

The Wisconsin River Pulp & Paper Company, of Stevens Point, Wis., recently installed three pairs of 36-inch McCormick turbines built by the S. Morgan Smith Company, York, Pa. Each pair is mounted on a cast iron draft chest in a steel flume, and develops 350 h.p. with 200 revolutions under a working head of 18 feet. The Smith Company claim to build the highest speed cylinder gate turbines now offered the public. They also furnished the International Paper Company three pairs 39-inch and one pair of 36-inch McCormick turbines mounted in a similar manner, which when tested at Holyoke gave 85 per cent. efficiency and extraordinary speed. These wheels are developing 7,200 h.p. under 50 feet head and are used for operating pulp grinders at Rumford Falls, Maine.

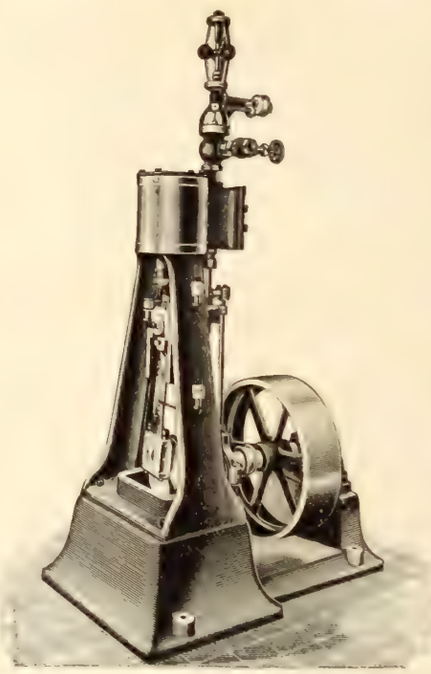
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SPARKS.

Barkey Bros. have secured the contract for lighting the town of Tilsonburg, Ont.

The contract for wiring and lighting the new building of the Ontario College at Guelph, Ont., has been awarded to the Guelph Light & Power Company.

C. M. Bowman, M.P.P., is interesting himself in the development of the water power of the Savgeen river at Southampton, Ont. It is estimated that a dam built across the river would furnish 1,000 horse power.

W. M. German, M.P., and B. Payne, of Niagara Falls, Ont., last week submitted to the Dominion Government the plans of the Ontario Power Company for developing water power at Niagara Falls. It is proposed to take the water by a canal to the Welland River at Chippewa.

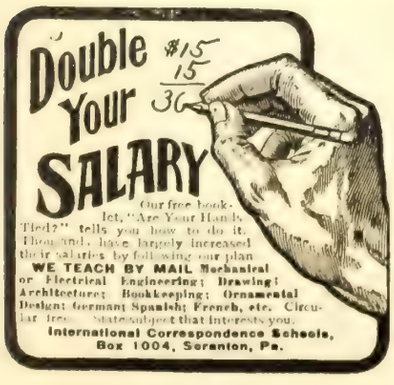
A talk on "Wireless Telegraphy" was given before the Toronto Engineers' Club on December 3rd, by Prof. T. R. Rosebrugh, of the School of Practical Science. The attendance at the meeting was large and the lecture most interesting, practical demonstrations being given by means of apparatus provided by the lecturer.

We are indebted to the Street Railway Company, 120 Liberty street, New York, for a copy of "Practical Electric Railway Hand Book," by Albert Herrion. The author of this work has succeeded in getting together a great deal of valuable data directly applicable in the construction and operation of electric railway systems. There are many illustrations of such appliances, structures and methods as have been adopted in practice by street railways in the United States. As an appendix we find an interesting chapter on storage batteries and boosters and another on underground conduits.

There is a collection of odd addresses in the Goldie & McCulloch Company's office at Galt that is decidedly interesting. The peculiar and various ways the firm's name is spelled and the unique addresses are very amusing. Frequently letters are addressed to this firm to Brantford, Toronto and Guelph. One English firm recently addressed a letter "Galt, Canada, near Toronto." But some little idea may be gained of how widely the firm of Goldie & McCulloch is known throughout Canada by the fact that a letter from British Columbia was addressed them to Guelph, but was not delivered to the Guelph office. Apparently the mail clerk on the train was so familiar with the firm name of Goldie & McCulloch that he overlooked the letter's address and put it in the Galt Mail bag.—Galt Reformer.

The ratepayers of Newcastle, N.B., carried a by-law on December 6th to raise $76,000 for the purpose of providing an electric light plant and waterworks and sewerage system. D. Morrison is Mayor of the town.

A subscriber to the ELECTRICAL NEWS writes that he is in the market to purchase a successful electric lighting business. Any of our readers having such a business to dispose of should communicate with this office.



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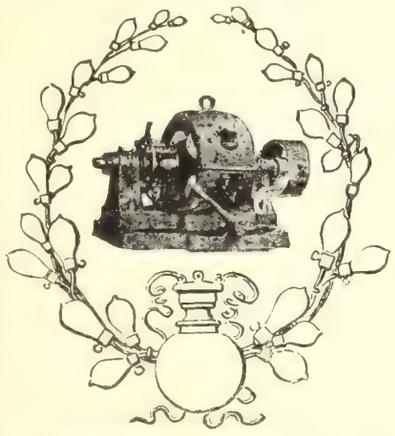
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SPARKS.

The Canadian General Electric Company are opening an office in London, Ont.

Mr. Robert H. Smith is reported to have sold his electric light plant at Tilbury, Ont., to Mr. F. A. Nelson.

Mr. E. Kyle has been given a contract to light the streets o Merrickville, Ont , for five years, at the price of $660 a year.

United States capitalists are said to be negotiating for the establishment of an electric street railway system in Levis, Que

George Clinton has submitted a proposition to the village council of Cumberland, B.C., to install an electric light plant there.

The Grant-Hamilton Oil Company are building a new factory on Strachan avenue, Toronto. It will be 200x100 feet and two storeys in height.

The town engineer of Goderich, Ont., has recommended the purchase of two 100-light transformers and other supplies for the electric light plant.

The town council of Paris, Ont., has passed a by-law granting a fifty year franchise for an electric railway to Dr. Ickes and J. C. Wallace, representing the Von Echa Company.

Mr. G. G. McPherson, K.C., representing a syndicate, has applied to the city council of Stratford, Ont., for a franchise for an electric railway to be built between that city and Mitchell.

Mr. L. A. Campbell, of Rossland, has secured from the Cascade Power & Light Company the contract for the erection of their pole line from Cascade to Phœnix, B.C. The power house and head works will be built by Mr. John Copp. The total work will cost in the neighborhood of $50,000.

Persons interested in the development of power at Lac du Bonnet, Man., purpose building an electric railway from Winnipeg to that place. Mr. H. Burkholder, of Chicago, is mentioned as the promoter. The cost of the road will be in the neighborhood of $1,000,000, and the length 62 miles. The erection of pulp and carbide mills at Lac du Bonnet, to be operated by electric power, is also spoken of.

The citizens of Douglas, Man., are talking of taking steps to install an electric light plant.

The council of the town of Orillia, Ont., are asking $17 per horse power per annum for electrical power from Ragged Rapids.

The town council of Orillia, Ont., are announced to have awarded the contract for electric plant to the Canadian General Electric Company.

Mr. R. E. T. Pringle, of Montreal, is wiring the Elder-Dempster steamer Monmouth for lighting purposes. The work is being done at St. John, N. B.

The Dominion Subway Company is asking for incorporation, to construct underground subways and cables in the city of Montreal. The applicants include Messrs. C. F. Sise and Robert Mackay.

Mr. H. P. Dwight, president and manager of the Great Northwestern Telegraph Company, Toronto, has presented 96 volumes of standard works to the library of the Muskoka Sanitarium.

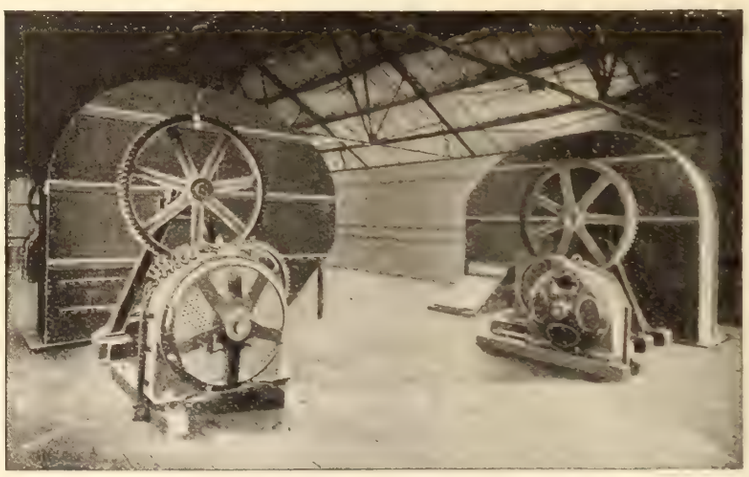
Mr. Frank G. Walsh, local manager of the Bell Telephone Company at Winnipeg, has as a result of ill-health, been granted six months' leave of absence and has gone to Southern California. His many friends look forward to his return next spring in improved health.

Fourteen British, one Canadian and one German firms are announced to have entered vehicles for the forthcoming competition for self-propelling lorries for military purposes. The trials will commence on December 4 and will take place in the vicinity of Aldershot, England.

It is rumored that the Peterborough Hydraulic Company which is really the Quaker Oats Company, are endeavoring to secure a controlling interest in the Peterborough Light & Power Company. It is understood to be the intention of the former company to develop their water power to its full extent, and plans for the equipment of the old power house on the Ashburnham side of the river have been prepared.

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e nver, Mountain Electric Company, G. & O. Baniff & Co., City of Mexico.

SPARKS.

The directors of the Windsor Hotel, Montreal, are considering the question of installing a system of telephones throughout the building. The idea is to have a telephone in each of the four hundred rooms.

The town council of Cornwall, Ont., is considering the taking over of the plants of the Cornwall Electric Light & Gas Company, and a by-law to that end may be submitted to the ratepayers at the January elections.

The Otonabee Power Company, of Peterborough, Ont., has been granted a lease by the Dominion government of the power available at No. 5 dam on the Otonabee River. The energy is estimated at 625 horse power and the price is $2 per h. p.

The civic officials of Toronto Junction, Ont., are still discussing the lighting problem. Mr. Joseph Barrett, representing the Humber Light & Power Company, is asking $60 a year for each 2,000 c.p. light while Mr. Keith has offered to supply 300 c.p. lights at $31 a year.

It is likely that a by-law will be submitted to the ratepayers of Brockville, Ont., to raise the sum of $50,000 for improvements to the lighting system. The improvements recommended by the commissioners include two new dynamos, new transformers and meters, lightning arrester and switch-board.

The Owen Sound Electric Light Company have just installed a 50 light bi-polar dynamo in the saw mill of Maitland, Rixon & Company at Owen Sound, Ont. The power is obtained from the mill engines. This makes the fourth plant which the above company have installed in Owen Sound, the others being 600 lights for the North American Bent Chair Company, 200 lights for the National Cable Company, and 200 lights for the Grey & Bruce Portland Cement Company.

A cat was the cause of much trouble to the International Traction Company and the Niagara Falls Power Company. The cat climbed a trolley pole on the Buffalo and Lockport electric railway and endeavored to walk on a feed wire. Her tail touched the parallel wire and a short-circuit was the result. A fuse at the Niagara Falls power house was burned out. It is said that about two hours elapsed before the cause of the trouble was located.

A resolution has been passed by the Finance Committee of the Montreal city council to the effect that permanent inspectors be engaged to inspect all electric meters and to inspect and examine regularly underground wires.

The Cataract Power Company, of Hamilton, is considering the advisability of extending its lines so as to light the village of Grimsby, Ont., in which case the electric plant owned by Mr. VanDyke would probably be taken over.

At the coming session of the provincial legislature the application for the incorporation of the Toronto & Hamilton Railway Company will come up. The company asks for power to construct an electric railway between Toronto and Hamilton.

The by-law authorizing the purchase by the town of Almonte, Ont., of the Metcalf water power has been finally passed in council. A committee has also been appointed to purchase the necessary supplies for the electric light plant.

Experiments with "optical telegraphy," made under the direction of the French Military Engineering Department, have just been concluded at Nice, with the result that all the forts along the Italian border are to be supplied with "optical telegraphy." The experiments consisted in making luminous projections towards Toulon and Corsica. The distance is 70 miles in one direction and 135 miles in the other, and the system is said to have worked with an efficiency that surprised General Pamard, under whose supervision the trials were conducted.

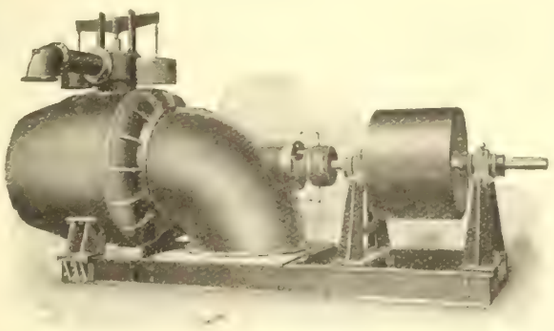
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SPARKS.

The Brockville Light & Power Company, Limited, of Brockville, Ont., has by a special resolution of the shareholders, resolved to go into dissolution and wind up the affairs of the company.

At a meeting of the directors of the Niagara, St. Catharines and Toronto Railway Company, held last week, Mr. John W. Herbert, of New York, was elected president, and Mr. Æmelius Jarvis, of Toronto, secretary.

A number of Hamilton and Toronto stock-holders in the Metropolitan Electric Company met in Toronto recently and appointed a committee to go to Ottawa and make a personal examination of the works in progress, with a view to allaying certain skeptism as to the value of the company's works and franchise.

Mr. James Wilson, of the C. P. R. Telegraphs, announces that work on the first section of the Pacific cable will begin on January 1. The first span to be laid will be that from Banfield Creek, Vancouver Island, to Fanning Island, a distance of 360 miles. This length of cable will weigh 8,000 tons.

A cable from London, Eng., states that there were 372 tenderers for the construction of the twenty thousand horse-power plant for the South London electric tramways, half of them being from American and German bidders. It is the larges contract of the kind ever secured by a British firm.

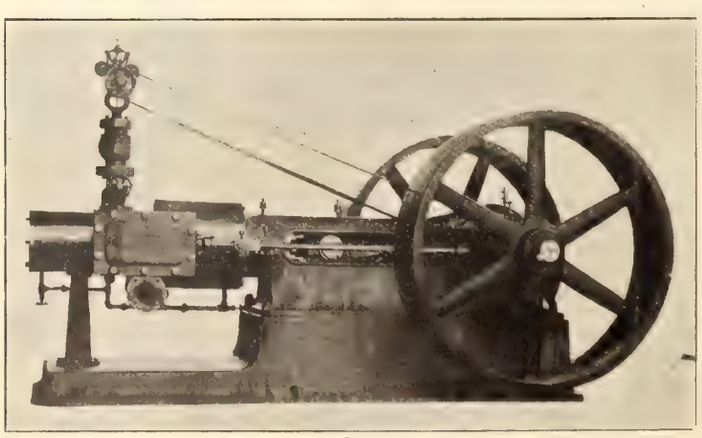
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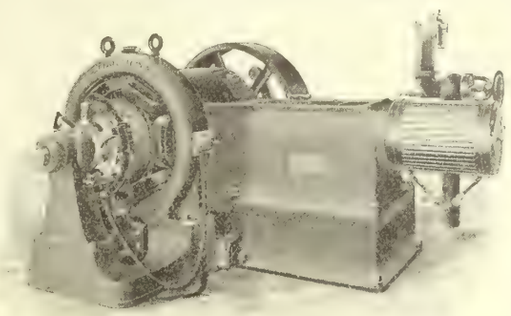
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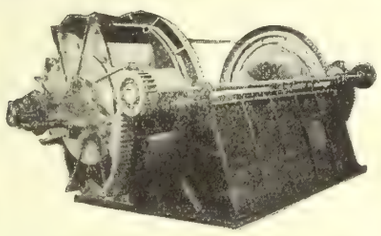


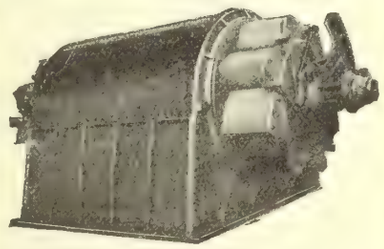
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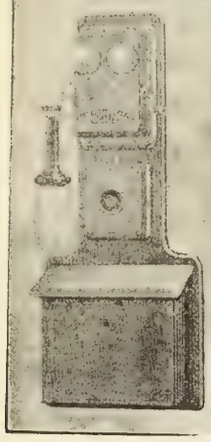
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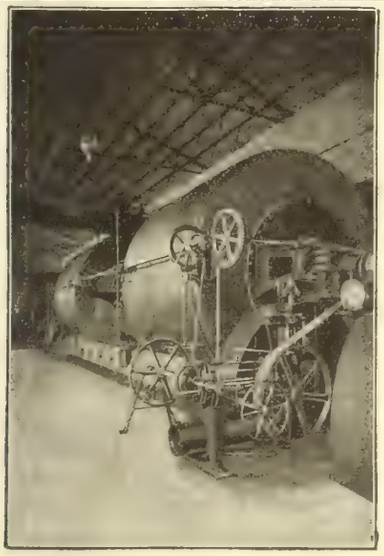
The British Columbia Electric Railway Company are about to commence the erection of a new boiler house in connection with their plant at Vancouver, B.C.

The Aurora Electric Light Company, of Aurora, Ont., have made improvements to their power house by the erection of an addition of 12 feet to the building and a large brick chimney.

At the forthcoming session of the Ontario Legislature an application will be made for the incorporation of the Toronto & Hamilton Electric Railway Company, to build a railway from Toronto to Hamilton.

A by-law has recently been carried by the ratepayers of Newcastle, N. B, to provide funds for waterworks, sewerage and electric light systems. It has been decided to engage Mr. Willis Chipman, C.E., of Toronto, to prepare the necessary plans and superintend the work of installation.

Pending the settlement of the arbitration suit in connection with the proposed purchase of the electric and gas plants by the corporation of Kingston, an agreement has been reached by which the Kingston Light, Heat and Power Company will continue the contract quarter by quarter until the vote of the ratepayers is taken to decide the question of purchase.



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WRITE FOR CATALOG. DEPARTMENT E.

TRADE NOTES.

The Robb Engineering Company are building four 100 horse-power Mumford boilers for the new round houses of the Intercolonial Railway at Stellarton and Sydney, N. S.

The Canadian General Electric Company have sent out an attractive and useful Diary for 1902, 8½x10 inches in size. On the front cover is a female figure holding aloft an electric lamp, a spray of autumn maple leaves and the name of the company. The back cover shows an excellent view of the company's works at Peterborough. Following the last memoranda pages are tables giving common fractions and their decimal equivalents, and the weight and resistance of pure copper.

At a meeting of the leather belting manufacturers of Canada, held on the 2nd inst. at the Windsor Hotel, Montreal, it was resolved that on account of the very high price of hides it was necessary to advance prices twenty per cent., to take effect at once. For the same reason all the manufacturers in the United States in this line of goods advanced their prices on the 12th ult. to the same extent.

The Goldie & McCulloch Company, Limited, of Galt, Ont., are very busy in all departments. The following orders booked in November will give some idea of the volume of business done by this firm :—6 Wheelock engines, 4 boilers, 1 heater, 1 large complete flour mill plant (gyrator system), for Welland Ont.; other flour mill machinery for New Brunswick, 83 grain storage tanks and 16 steam pan dry kiln for American Cereal Company of Peterborough, which completed an order for 44 of those pans, 6 gas engines, some of which go to Manitoba, and 3 emery choppers. In the wood tool department they are also busy, having booked 10 orders for large tools, and in the safe department besides several single orders for safes and vault doors, they have sold a carload for Sydney, C. B.

Incorporation has been secured by the Otonabee Power Company, Limited, of Peterborough, with a capital of $200,000. The personnel of the company is Messrs. G. W. Ferguson, Adam Hall, W. T. Hall and G. L. Hay, of Peterborough, and John A. Bennett, of Otonabee.

SPARKS.

The ratepayers of Souris, Man., are discussing the question of lighting the village by electricity.

The Sarnia Gas and Electric Light Company, of Sarnia, Ont., are installing a new generator of large capacity.

The opinion of the ratepayers of Guelph, Ont., on the question of municipal control of street lighting is to be tested on January 6th.

The management of the Intercolonial Railway have decided to install an electric plant for lighting their buildings and yards at Sydney, N. S.

The street railway at Belleville, Ont., has finally been purchased by Messrs. A. E. Lewis and Walter Alford, of that city. The price is given as $6,500.

The annual meeting of the shareholders of the Winnipeg Electric Street Railway Company will be held in the city of Winnipeg on January 22nd.

Mr. Irwin Hilliard, of Morrisburg, is promoting a company having for its object the building of an electric railway from Morrisburg to Winchester, Ont.

The contract for building 75 miles of telegraph line near Alberni, B. C., has been awarded by the Dominion Government to T. D. Conway, at the price of $6,400.

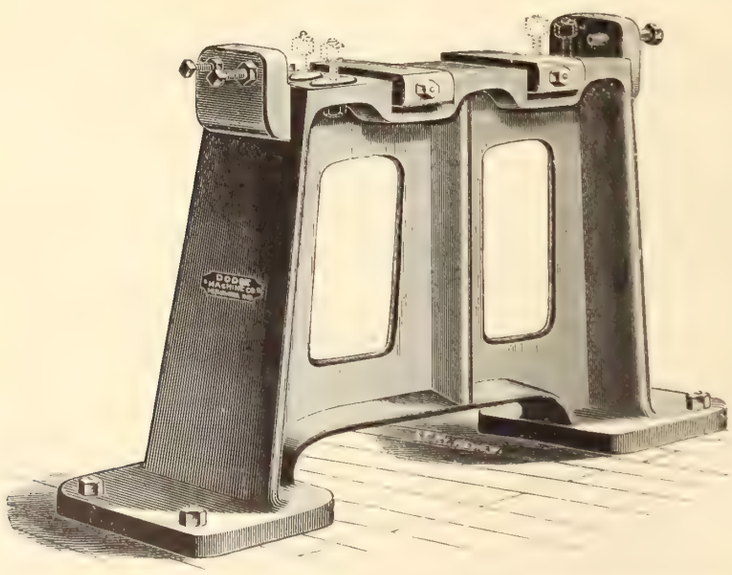
The Granby Rubber Company, of Granby, Que., contemplate building an industrial railway system in connection with their works. The railway will be narrow gauge and operated by electricity.

The London Railway Company, of London, Ont., is applying for incorporation, to build an electric road from Ingersoll to London. The incorporators include Messrs. F. G. Rumball, T. H. Purdom and T. C. Knott.

Mr. W. J. Smith, chief engineer of the Dominion Government buildings in Toronto, died at his residence, 381 Markham street, on December 30th last. He had been ill for some time. Mr. Smith in early days was a well-known contractor, and was connected with the work of straightening out the Don river. When the Laurier Government came into power he was appointed to succeed ex.-Ald. Wm. Bell as engineer of Government buildings.

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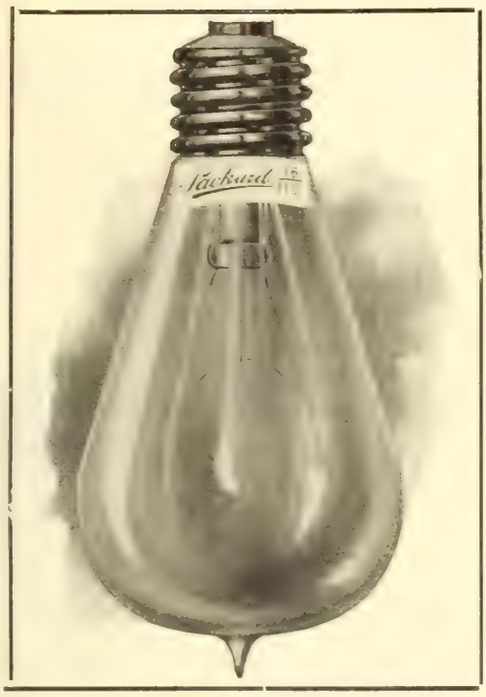
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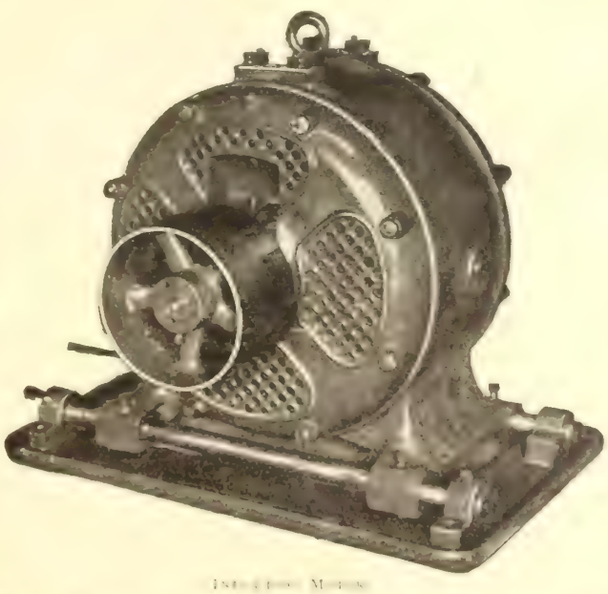
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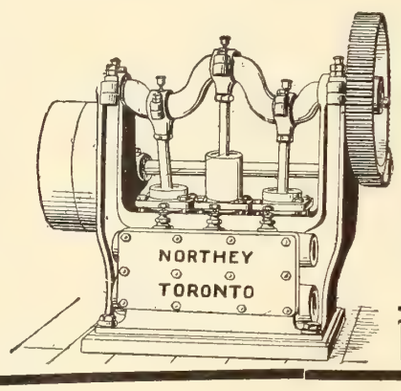
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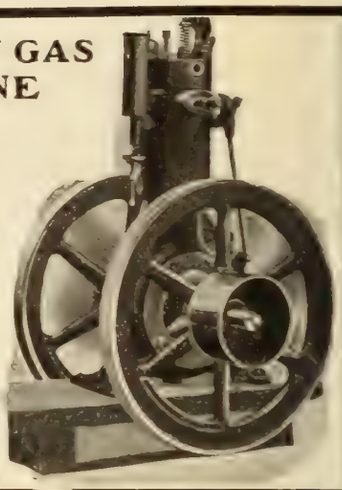
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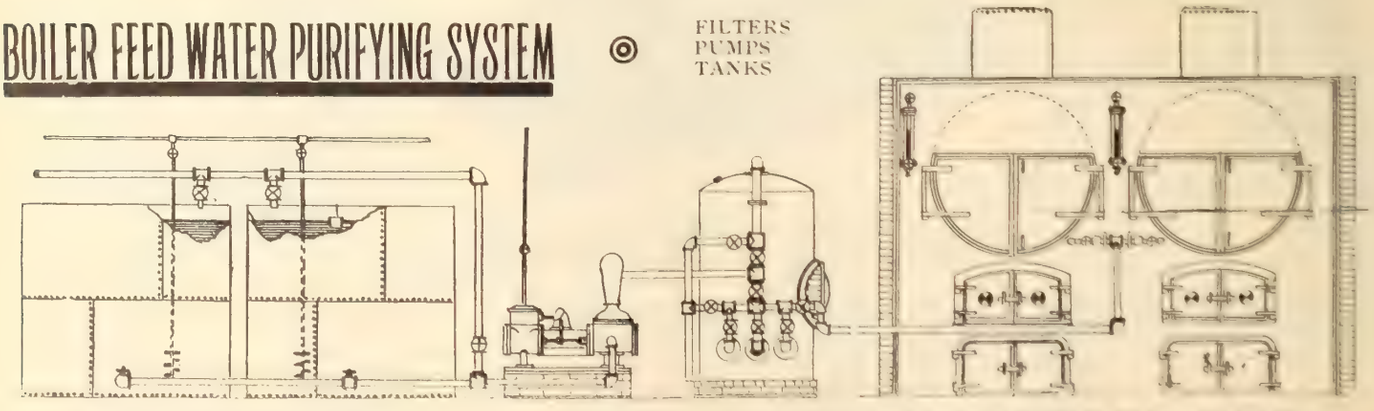
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ELECTRICAL NEWS

AND

ENGINEERING JOURNAL.

VOL. XII. JANUARY, 1902 No. 1.

STORAGE BATTERIES AND 60-CYCLE RAILWAY ROTARIES.

BY EDWARD L. REYNOLDS.

The use of storage batteries upon electric railways and lighting stations has within the last few years reached great prominence, and it has become an accepted fact with most engineers that batteries should necessarily form part of modern designs for power systems of this character.

The most customary applications of batteries to electric railway systems in the past have been in the stations where direct current is generated, and at points far out upon the lines, say from five to ten miles from the power house. In both cases the batteries have in general been installed to regulate the excessive fluctuations in load peculiar to railway work. By thus relieving the machinery and copper of these rapid changes in load, and obtaining a constant load factor approximating 100 per cent., the cost of operation, the maintenance of machinery and the first cost of machinery and copper have been in a great many cases reduced to an astonishing degree. Batteries have also been used very extensively in connection with roads operating from high-tension alternating-current transmission with rotary conversion to 500 volts direct current, the battery in such cases being installed in the power house and in the rotary sub-stations.

The advantage of installations of the above general character are too well known for additional comment here, but it is the desire to call attention to one particular use of batteries in conjunction with 60-cycle rotary converters that prompts the following brief description of the Hamilton Electric Light and Cataract Power Company, of Hamilton, Ont. This application of the battery idea is of quite recent origin, and deserves most earnest consideration.

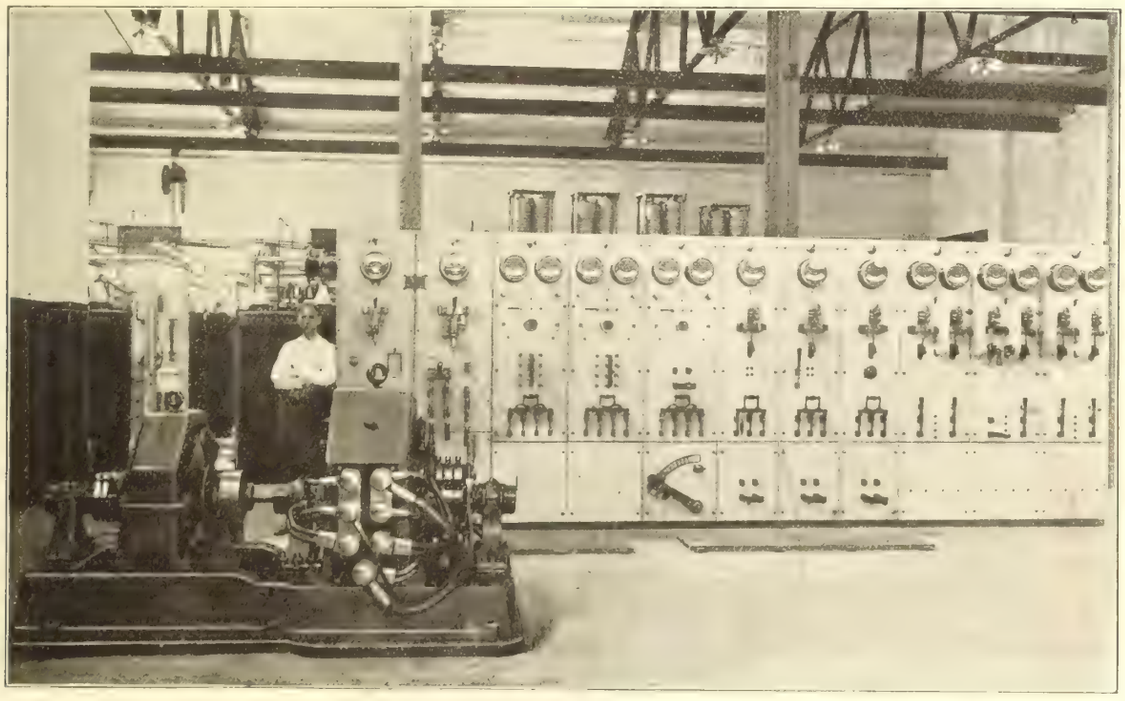


FIG. 1.—SWITCHBOARD AND BATTERY BOOSTER.

This company generates from water power. The water is taken from Lake Erie near the last lock of the Welland canal, and led about twelve miles to the edge of the mountain. Here it has a head of 275 ft., and falls to the wheels through an iron flume of 8 ft. diameter at the top and 6 ft. at the bottom. Electric power is generated at 2400 volts, two phase, and stepped up to 22,000 volts, three phase, and thus delivered thirty-four miles to Hamilton.

The sub-station at Victoria Avenue, Hamilton, contains all the machinery required to transform and distribute the current for the various uses required. Thus power is distributed to the Hamilton Street Railway Company, the Hamilton and Dundas Railway and the Hamilton Radial Railway, and is also used

for light and power in the city. This light and power consists of 110-volt incandescents and arcs and alternating-current motors. The apparatus in the sub-station consists of three 300-kw, 66-cycle rotary converters, with 550-volt secondaries, ten 175-kw static transformers, 22,000-volt three phase to 2,400-volt two phase, six 150 k.w. static transformers,

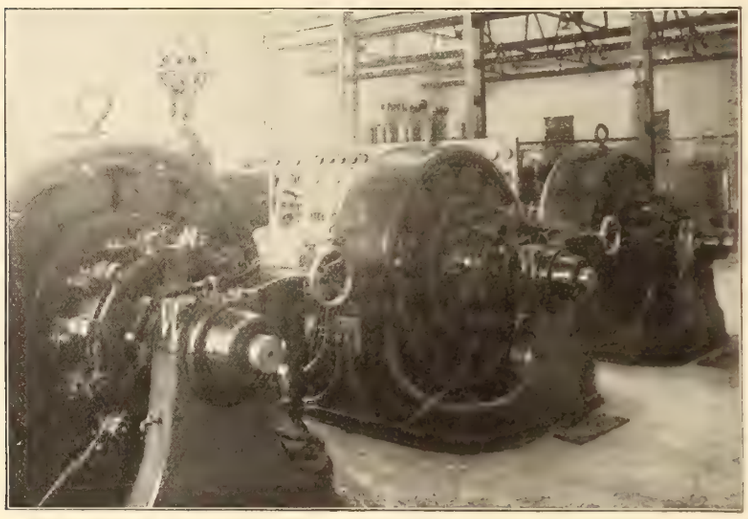


Fig. 2. Three 300 K. W. Rotaries.

22,000-volt three phase to 350-volt two phase, and a storage battery of "Chloride Accumulators" of capacity equal to 400 amps. at 550 volts.

The switchboard and battery booster are shown in Fig. 1, the rotaries in Fig. 2. The transformers are shown in Fig. 3. These machines supply current to the railways, and are operated in parallel with the storage battery. The latter absorbs the fluctuations of the current and enables the rotaries to run steadily with a fixed constant load, which represents the average demand of the railway circuit. It is this fact that renders it possible to operate incandescents and arcs, electric street cars and synchronous motors from the same busses fed from current over the same high-tension transmission line.

The regulating effect of this battery is shown by the two cuts, Figs. 4 and 5. Fig. 4 is a reproduction of a voltage curve taken from a recording volt-meter while the battery was in service. This voltage is taken upon the 110-volt lighting circuit, and shows a variation of such small magnitude that it is not detected from observation of the lights. Fig. 5 is a reproduction of a similar curve during a corresponding period of another day when the battery was off the circuit. Here, under the same local conditions, a fluctuation in voltage of large magnitude is seen, rendering operation impracticable.

This battery has uses other than the regulation of fluctuations. Frequently upon a system of this character some trivial accident to line or machinery will cause temporary shut-downs. In the plant under consideration such accidents have occurred several times, but the roads have never been closed down, since the battery has discharged upon such occasions to tide over the troubles. The Hamilton Company has found that one of the strongest points with regard the operation of this battery lies in the fact that it would hardly be possible to operate the rotaries without the battery on account of hunting. An additional advantage of this battery is that of supplying current to the roads during the early morning hours, when the load is light, thus giving an all-night service without the necessity of operating the rotaries continuously.

The flexibility of this system is marked, and the advantage of operating lights, synchronous motors and direct-current motors from the same transmission line is of manifest importance. It is sufficient to say that the storage battery has thus opened a field in which lighting and railway interests become one, and it is safe to predict that all high-tension transmission lines designed to supply direct current through rotaries for railways will be laid out upon the above general plan, and light furnished from the same lines wherever it is applied.—From the Street Railway Journal.

THE BREMER ARC LAMP.

Mr. Laporte read a paper before the International Society of Electricians in Paris recently, giving the results of tests of the Bremer arc lamp made in the central laboratory of electricity in Paris during the last exhibition. According to the Electrical Engineer the characteristic features of the Bremer lamp are the arrangement of the carbons, which are nearly vertical, but form an acute angle; the regulation of the arc under the influence of a magnetic field, the regulation being made automatically by the intensity of the current; and the use of a special positive carbon, the composition of which is still kept secret. For a 43 to 45 volt and 9 ampere lamp the special positive carbon has a diameter of 7 mm., while for the negative carbon a Siemens carbon of 6 mm. diameter is used. The special positive carbon has a considerably higher specific resistance—12,300 microhms centimetre—that of the Siemens carbon being between 8,300 and 9,400. The positive carbon contains a certain number of metallic salts, and during combustion rather large quantities of deposits are formed, magnesia being the

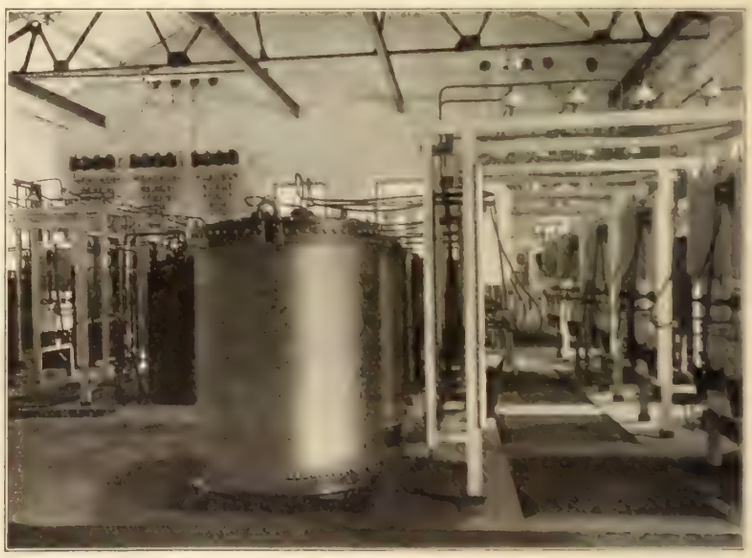


Fig. 3. The Transformers.

principal constituent. This magnesia is deposited on a screen above the arc, which then acts as a reflector and produces a favourable distribution of the light.

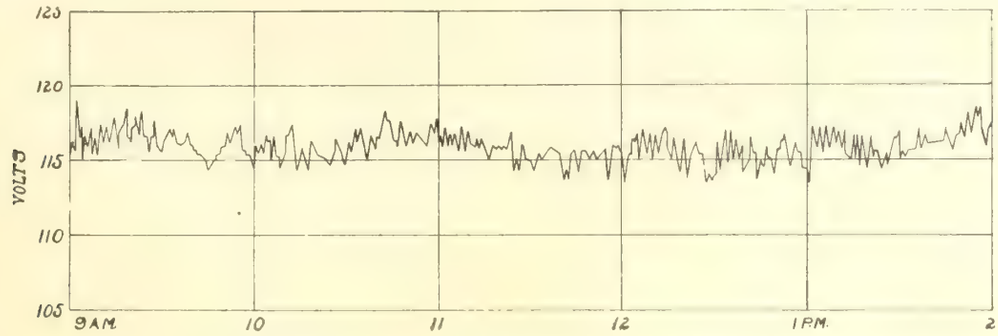


Fig. 4.—Voltage Curves, with Battery in Circuit.

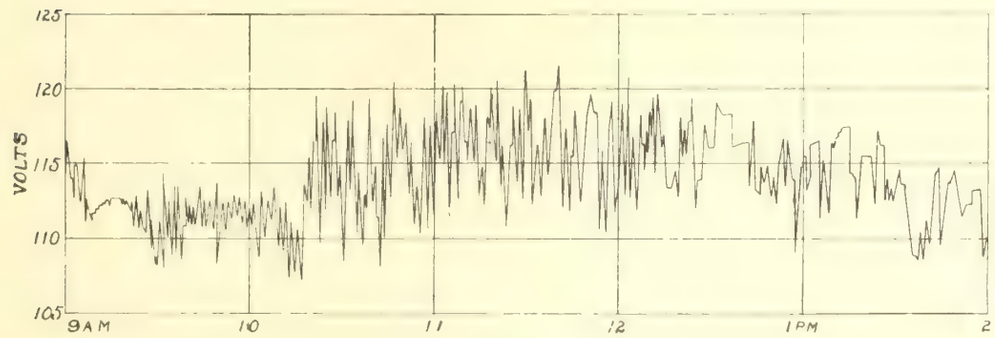


Fig. 5.—Voltage Curves, Without Battery in Circuit.

The colour of the light is peculiar ; it is between the colour of the light of incandescent lamps and that of ordinary arc lamps without globe. The results of photometric tests and the comparison with an ordinary arc lamp show that the consumption of watts per candle for the ordinary arc lamp is about twice that for the Bremer arc lamp, the exact ratio taken from the table being 200 : 117. Referring to the results of his tests, the author says : "It cannot be denied that these figures are favourable to the Bremer lamp. The only point which still needs to be cleared up is whether the price of the special carbon may not offset the advantage put in evidence by the photometric tests."

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No. 6. View in Battery Room.

CANADIAN ELECTRICAL NEWS AND ENGINEERING JOURNAL

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Correspondence is invited upon all topics coming legitimately within the scope of this journal.

The "Canadian Electrical News" has been appointed the official paper of the Canadian Electrical Association.

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The Question Department.

THE interest that is being shown in the Question and Answer Department of this journal is most gratifying to the publishers. A large number of readers have accepted the invitation to submit questions, and as a result it has been possible to give information touching a wide variety of subjects. We are thankful to those who have sent in questions, as we feel that, besides the assistance which has been given them, a live question and answer department is one of the best means of making the journal useful to and appreciated by subscribers. Questions for the February issue are now in order.

Suit Affecting Electric Lighting.

THE Ottawa Electric Company are the plaintiffs in a suit now before the Ottawa courts that is of considerable interest to electric lighting companies. The action arose out of the Ottawa-Hull fire of April, 1900, by which a large portion of the circuits and other property of the Ottawa Electric Company were destroyed. The present action is brought to recover the amount held by the corporation for alleged breach of contract. Under its agreement with the company the city is entitled to deduct 50 cents a light for the lights which are out at times in different parts of the city when they should be burning. The company, however, claim exemption in this instance, on the ground that it was through no fault or negligence on their part that the lights in question were not burning. The amount involved is between $12,000 and $15,000. Whatever may be the decision, it would seem to be a wise precaution for lighting companies to endeavor to have embodied in their agreements with municipalities a provision covering such a contingency as was responsible for the suit in question.

Electricity in Glass Making.

IT is interesting to watch the constantly broadening uses of electricity. Eventually its applications seem likely to become almost as numerous as the varied branches of industry. It is now proposed to employ a continuous electric furnace in the manufacture of glass. Since the glass is electrolytically decomposed by a continuous current, it is necessary to employ alternating currents for the electric glass furnace. The furnace contains three electric arcs, arranged along an inclined plane. Below each arc is a pocket in which the fused mass can collect and overflow to the next one. The crushed and mixed material is fed in a continuous stream, the fused glass being drawn off in like manner. The lower temperature of fusion of glass-making material as compared with those employed in the manufacture of calcium carbide, has made possible the construction of a continuous furnace. An important advantage to be secured by the use of the electric furnace in glass factories is

the saving in cost and maintenance of plant, such as furnaces, regenerators, gas producers, etc. By the electric furnace the heat necessary to immediately fuse the powdered material is always available, thereby saving time. It also permits of glass-making wherever water power is available, instead of in certain localities only in which cheap fuel can be had.

Mond Gas and Gas Engines.

In our November issue some particulars were given of the Mond fuel gas which is being exploited in England. We have since received a copy of a report on the subject made by Mr. Edward Atkinson to the Boston Manufacturers' Mutual Fire Insurance Company. Mr. Atkinson has recently returned from England, where he investigated the process of producing the gas. He states that large steam plants are being wholly removed in order to make way for the introduction of Mond gas and the gas engine. In making this gas no coke is produced, but practically the whole of the coal is burned away by a minute supply of air and steam. Dr. Mond, the inventor, is able to use ordinary slack coal and to turn this into gas at so low a temperature as to obtain much more ammonia than can be got from the coal distilled for illuminating gas. This producing gas has no illuminating qualities, but is used principally for two purposes, namely, as a source of motive power in gas engines, and in the employment of furnace heat by the aid of regenerators. It is claimed that the sulphate of ammonia obtained will repay three-fourths of the cost of the coal used.

Sir Frederick Bramwell makes some interesting comparisons between the gas engine and the steam engine. With the best steam engine he estimates that only 14 per cent. of the energy of the fuel is utilized, while with the gas engine twice that amount can be obtained. Between the ordinary gas engine and the ordinary steam engine, the comparison is much in favor of the former. In a test made in Birmingham a few years ago the average consumption of eight steam engines was such as to give only about 4 per cent. of the fuel energy, whereas Bramwell contends that a reasonably good gas engine will give seven times this amount. He claims that the replacement of steam engines by gas engines would save four-fifths of the coal now consumed. Another point advanced in favor of the Mond gas engine is that the ammonia produced yields a money value of 4 shillings 6 pence per ton of coal consumed. If the results claimed by Bramwell can be obtained, producer gas may well receive the attention of owners of steam plants. One objection, however, to the Mond process is that it can only be applied economically in large establishments requiring not less than one hundred horse power. Another objection, and perhaps a more serious one, is that the gas is intensely poisonous and must be used with great care to prevent leakage.

An act governing the supply of this gas for power and heating purposes has been passed in favor of the South Staffordshire Mond Gas Company. The maximum price is fixed at three pence per 1,000 cubic feet to consumers requiring not less than 16,000,000 cubic feet per annum, and four pence to consumers requiring less than this quantity. The act places the minimum heating value of the gas at 125 British thermal units per cubic foot, and the gas must never contain more than 14 per cent. of carbon monoxide. If the consumer uses the gas for lighting purposes the company may cut off his supply.

Ocean Telegraphy.

The recent achievements by Signor Marconi towards the transmission of messages across the Atlantic without the employment of wires has aroused intense public interest in that system of telegraphy, and placed it in the category of commercial possibilities. Marconi's success, if such it may be termed, has been speedily accomplished, as it was in the year 1895 that he first turned his attention to wireless telegraphy. From laboratory tests he gradually increased the distances over which the messages were transmitted until he has finally bridged, as it were, an ocean space of nearly two thousand miles. For military purposes wireless telegraphy has been found advantageous by all the leading nations of the world, including Great Britain, France, Germany, Japan and Russia. The Government of Canada has recognized its advantages by employing the system for transmission of messages across the Straits of Belle Isle. The longest distance covered previous to the trans-Atlantic experiments was 186 miles. This was from the Isle of Wight to Cornwall, England. Gradually the obstacles were overcome. Marconi claims to have removed the objection of want of privacy by tuning his receiving instruments so that the messages will respond only to the tuned instruments.

Marconi's success has been doubted by such electricians as Edison, Greely and others, but this is only what might be expected when it is remembered how much incredulity attended the laying of the first trans-Atlantic cable and the introduction of other inventions representing recent electrical progress. The achievement is such as should elicit both admiration and commendation from scientists and the public at large. Admitting that what Marconi claims to have accomplished in sending signals across the Atlantic to be true, the question at once suggests itself whether the system is commercially practicable. On this point no one can speak with certainty ; developments must be awaited. If it is found possible to devise some scheme of non-interference to prevent confusion, so that the messages may be received at the point intended, a long step forward towards its adoption for commercial purposes will have been made. The absence of such provision has so far been one of the greatest objections to all forms of space telegraphy. Another point that suggests itself is the possibility of interference from fogs, clouds or storms. If wireless communication across oceans should be found feasible, it would result in greatly cheapening the cost of communication, and would be found of peculiar advantage to Great Britain and her Colonies. It is somewhat singular that only within the past year Prof. Pupin, of Columbia University, has invented a system of telephony without wires, making it possible to converse over much greater distances than were considered practicable.

The Berlin & Bridgeport Electric Street Railway Company, Limited, has obtained a charter of incorporation, to construct an electric railway between Berlin and Bridgeport, Ont.

MARCONI'S TELEGRAPHY EXPERIMENTS.



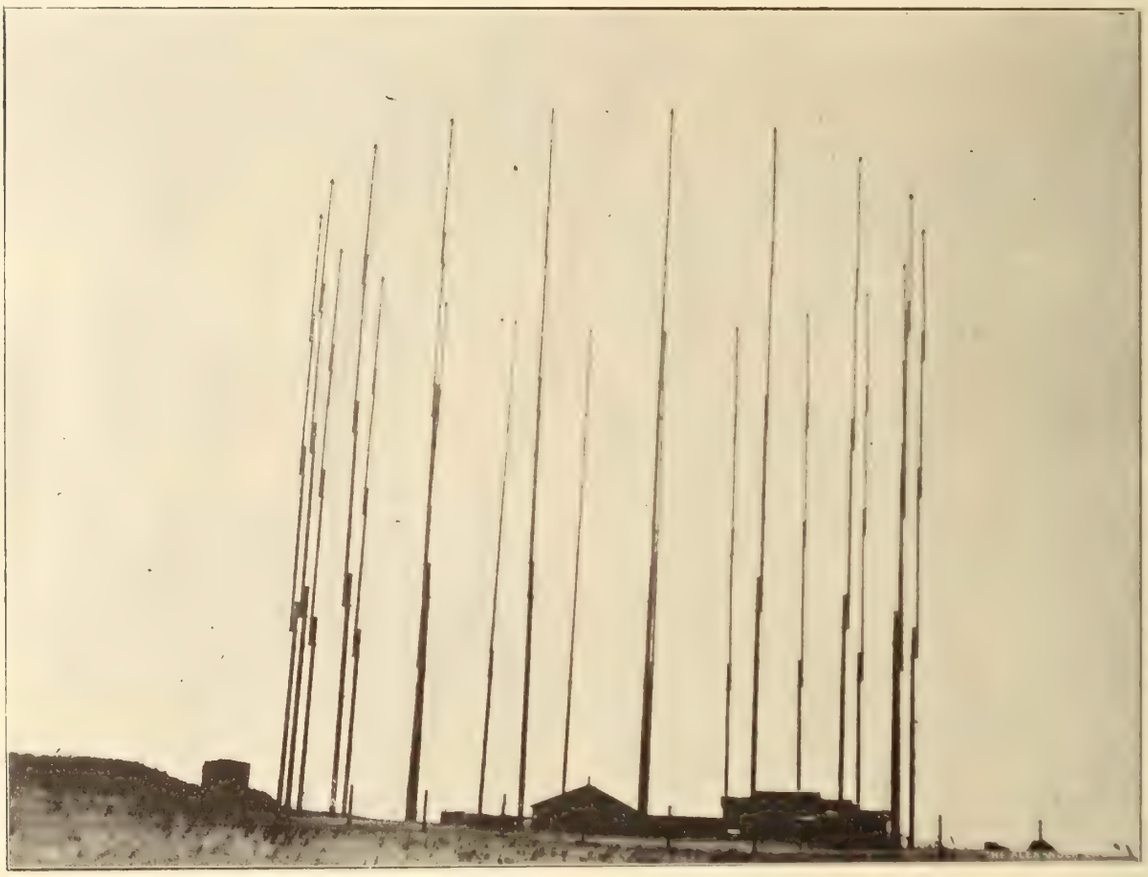
SIGNOR WILLIAM MARCONI.

On Decemher 15th the announcement was made by the press that Signor William Marconi had succeeded in transmitting signals across the Atlantic ocean without the use of connecting wires. At first there was much incredulity on the part of the public, but later details seemed to establish the fact that definite results had been achieved. Before leaving England Marconi had made arrangements to test the experiment. The two objective points were the Poldhu Station at Cornwall, England, and Signal Hill at St. Johns, Newfoundland, the distance between these two points being 2,100 miles. Marconi arrived at St. Johns on December 6th, bringing with him most of the essential apparatus for his experiments. Three days later he cabled to the Cornwall station orders to begin signalling according to a pre-arranged schedule, commencing at 3 p.m. daily and continuing until 6 p.m. During these hours Marconi elevated a kite with an ærial wire. He remained at the recorder attached to the receiving apparatus, and to his great satisfaction received signals at intervals under such conditions as assured him they were genuine.

The signals consisted of dots corresponding to the letters in the Morse alphabet, which is made by three dots or quick strokes. Again on Thursday, during the same hours, the kite was elevated and the same signals were renewed. Marconi states that he received the signals through a specially sensitive telephone attached to his instruments which enabled him to detect signals which the instruments would not record. The combinations were perfect though faint. Those received on Thursday were less distinct than those of the previous day. This is attributed to trouble experienced in keeping the kite elevated, owing to baffling winds.

At the station at Cornwall a large circle of twenty poles had been set up, each one of which is 150 feet high and bears an ærial wire. The electric force that is sent out from this transmitting station is said to be one hundred times greater than that at the ordinary wireless telegraph station.

When a permanent station is installed on this side Marconi will not be dependent upon fluctuations of the wind, and he is confident of making the signals strong and reliable, that is, not requiring such delicate and sensitive receiving instruments, by employing much greater power at the sending station.



VIEW OF POLDHU STATION, CORNWALL, WHENCE SIGNALS WERE TRANSMITTED.

Following the announcement of Marconi's success came an unexpected development. The inventor was served with legal documents from the solicitors of the Anglo-American Telegraph Company. These notified him that the company possess an exclusive monopoly to operate or construct within Newfoundland and its dependencies any system by which telegraphic communication can be obtained from any point in the colony to outside places. They demanded that he cease his experiments and remove his apparatus forthwith, otherwise the company would apply for an injunction restraining him from further tests. The difficulty has been referred to the London officials for negotiations, and it is expected that a satisfactory settlement will be reached. Meanwhile Marconi has temporarily ceased his experiments in Newfoundland and is said to have decided upon a point in Cape Breton

from which to conduct further experiments and to have investigated some other sites with a view to erecting a permanent station. The Dominion Government have offered him every facility for erecting a station on the Nova Scotia seaboard. At time of writing the inventor is in the city of Ottawa conferring with the Government officials. He will then proceed to England to assist in the negotiations with the Anglo-American



Harbor at St. Johns, Nfld—Signal Hill on the Left.

Company. It is reported that he expects to return to Canada early in the spring.

Guglielmo Marconi was born at Griffore, near Bologna, on April 25, 1874. His mother was English and his father was Italian. Since 1898 he has resided in England. In March, 1899, the first message by wireless telegraphy was sent across the English Channel, from South Foreland to Bologna, thirty-two miles distant. In the following summer the French naval vessel Vienne communicated with both France and England at a distance of 42 miles. A month later Marconi enjoyed the distinction of directing the manœuvres of the British fleet, sending messages more than eighty miles from one ship to another, and 130 miles through two ship stations. He subsequently came to America and successfully reported the international yacht races by his wireless system. His patents are controlled by the Marconi Marine Communication Company, Limited, and by the Marconi Wireless Telegraph Company.

MR. DWIGHT'S VIEWS.

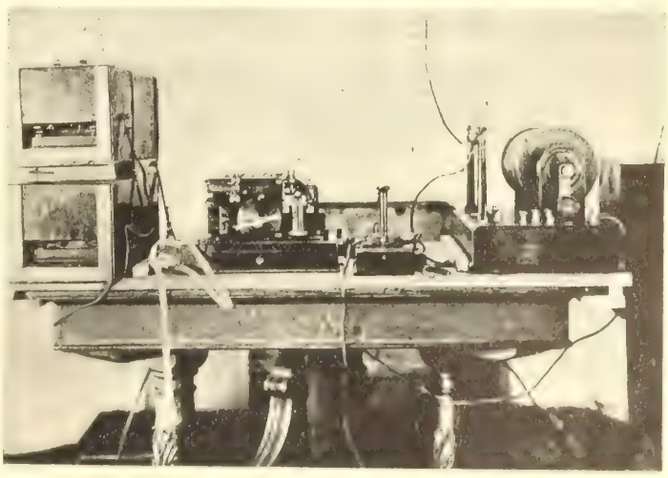
Concerning Marconi's experiments, Mr. H. P. Dwight, of Toronto, general manager of the Great Northwestern Telegraph Company, says :

" I learned a long time ago to believe that there was no limit to electrical development. I used to think there might be, but the older I get the more I am inclined to believe that this business of ours is in its infancy. The first Atlantic cable that was laid, 45 or more years ago, gave a little, feeble sign of life and expired. It was hardly more successful than this experiment of Marconi's in bringing a signal 1,700 miles across the Atlantic. It is well known, however, that the successful laying of that cable and the fact that it showed even a feeble sign of life gave confidence to enthusiastic promoters of cable telegraphy, and in due time capital was forthcoming for other cables, until there are to-day 14 Atlantic cables working regularly and successfully between America and the Old World.

" It can hardly be considered impossible or even unlikely that a similar development may take place in wireless telegraphy. It will take time, however, to do this. There are many difficulties to be overcome, but the best electrical experts in the world are alive to the situation, and it will not be their fault if wireless telegraphy does not become successful. When the telephone was first invented it was looked upon as simply a curious toy, and nobody ever dreamed of such a wonderful development of its use as we see to-day. I look upon the telephone as the most marvellous invention of the age. The wonder of it is overlooked in its familiar, every-day use. If it had been said twenty-five or thirty years ago that a time was coming in the near future, when a man seated in his office in Toronto could by means of a slender wire and an electrical current, hear his friend in New York and recognize his voice as clearly as if he were on the other side of the table ; or could, by like means, see him as plainly as if he sat before his eyes, such statements would have been looked upon as equally absurd and impossible. Yet, one of these is to-day a familiar thing, and the other is known to be theoretically possible, and not at all unlikely may become a common occurrence.

" I am reminded of an anecdote of Lord Kelvin, who visited, incognito, an electrical establishment where he was shown through by a young man, who expatiated at great length upon all the wonderful matters in connection with the establishment with an air of the greatest possible confidence, evidently intended to impress the visitor with the idea that he knew it all. When he got through, Lord Kelvin asked him, ' Can you tell me what electricity is ? ' The young man hesitated, and was speechless when Lord Kelvin added, ' I think that you and I know very little about it.'

" Wireless telegraphy cannot be said to be a new discovery. Electricians long ago discovered the sympathy between wires, say, on opposite sides of the street ; and they have been experimenting to see how



Marconi's Standard Apparatus.

this could be increased. Sir William H. Preece, the electrician of the British Post-office Department, has been experimenting for many years, and greatly increased the distance over which messages could be sent without wires. Marconi and others have simply expanded this idea, increasing distances, until now it would seem that a signal, at least, has been successfully sent over the Atlantic, a distance of about 1,700 miles. These experiments are not going to cease, and

it is incredible to suppose that there will not be great advances in this direction.

"Meantime it is but right to say that cable companies and telegraph interests are not greatly alarmed as to any immediate injury to business from wireless telegraphy. Whatever may be the success of the latter, there will always be abundant scope and use for all existing systems."

MARCONI'S ACHIEVEMENT.

By D. H. Keeley,

Superintendent Dominion Government Telegraph Service.

When a man gets his name up for anything he does or has in hand, he finds himself liable to answer for many things straightway ascribed to him that he never dreampt of in his philosophy. To Mr. Marconi many things have been ascribed in advance of his actual achievements. He has so far never taken the trouble to warn the enthusiasts who indulge in these imaginings against their going too fast. But after all that is the only thing he could warn them against ; for in the course of events one anticipation after another has been fulfilled as a natural consequence or a foregone conclusion of the wonderful work he is engaged in. Anyone being persuaded of this at the time the startling announcement was made of the attainment of trans-Atlantic signalling by the wireless telegraph, would naturally await confirmation of the report from the head centre. This confirmation is to hand. The writer has had it direct from Mr. Marconi himself since his arrival at Ottawa. There was a pre-arranged signal at a given rate from a costly transmission station at Cornwall, in England. When the perpendicular conductor at the coast of Newfoundland was elevated by balloon to a certain height, the receiving apparatus caught the expected waves and "hundreds and hundreds of them at the pre-arranged rate were received for several hours continuously." And, as the writer was given to understand, the concurrence of the transmitted and received signals was established by cable messages exchanged at the conclusion of the trial. All, apparently, that remains to be done is to duplicate, on this side of the Atlantic, the plant that is in operation in England ; then messages can be sent to and fro, and the adaptation of the Marconi system for spanning the seas will be demonstrated.

A great deal of fuss is being made over this remarkable achievement from the point of view of its bringing the two continents into communication. If that was all there is to it, Mr. Marconi would not long be remembered, because it's an old thing, and he would only have found a second way of doing what we now do and will do for years and years to come with the submarine wires. What Marconi has done puts it in our power to keep in touch with every ship that sails to sea. These vessels, needing only the requisite and now available equipment, can be in touch with both shores at all times. There need not be more than one line of communication. Mr. Marconi promises a lot of them to be obtained by means of an harmonic elaboration of his system. To my mind, one line would be enough. The more important ships at sea would be akin to the numerous offices on an ordinary long line of telegraph in the open country districts where the business of each office is small. In the aggregate, it is a very large business—and it pays ; but there is, nevertheless, not enough of it to occasion the stringing of second wire on the poles. So then, the single line of wireless communication embracing the seas would answer all requirements. It will create a new condition of things in the business of ocean travel and operations on the seas and must incidentally increase the work of the submarine cables immensely.

With increased traffic there is, of course, the possibility of the trans-Atlantic cable tolls being made lower than they now are, so everybody will be the better off and none will have occasion to regret the advent of the distinguished inventor who is so conspicuously instrumental in bringing it all about.

Ottawa, January 6th, 1902.

QUESTIONS AND ANSWERS

"Dynamo" : I would like a little more information than your reply to "Ambition" conveys in your November issue, about electrical heaters. I am running a small municipal alternating plant (1,000 x 52 v.), and would like to make the operator's room (10 x 12) a little more comfortable during the night. I have power and current to spare, and plenty of large galvanized iron wire. I am not particular as to efficiency, heat being the object, and if you could without taking up too much space explain the construction of a serviceable article it would be a favor. Must a transformer be used, or can it be run off the primary? My exciter is a 25 lighter (110 v.). Could it be run off that? Is the heat created by induction or direct? Are the two leads connected with the two terminals of one coil without danger of short circuit? If a cut-out or junction box is used, what size should the fuse wire be? What is the best way to wind non-inductively, or is non-induction absolutely necessary? If a case is used, what kind, and would an old "Babcock" do?

Ans.—It is not possible to give you very much information in the limited space available, but the following will give an approximate idea of how to set about the work, though you must remember that it is not possible to give exact figures, the results obtained varying very much with the arrangement of the room and the material used, ordinary iron wire especially varying very much in its composition and consequently its resistance. You must also bear in mind that the underwriters are likely to object to anything not the product of some well-known manufacturer. In addition to the iron wire you will need two pieces of 1 inch pine, eight inches wide, the length varying from 8 to 10 feet, depending on the gauge of your wire and the size of the mandrel on which you coil it, sufficient $\frac{1}{8}$ inch sheet asbestos to cover one side and the two edges of these boards, approximately 20 square feet, and about 25 square feet of wire netting, $\frac{3}{8}$ inch mesh, and screws, glue and small staples. Glue the asbestos onto the boards, so as to completely cover one side and both edges, and after coiling the wire onto a 2 or 3 inch mandrel, staple it along the centre of the covered side of the board, taking care to stretch it so that there is a space of about $\frac{1}{4}$ inch between each turn. Assuming that you have a No. 8 wire, we would suggest that you coil up about 325 to 350 feet, and after connecting one end to one of

the 52-volt transformer terminals, temporarily connect the other transformer lead to various points along the coil until you get a heat which keeps the room comfortable. Do not let the wire get too hot or it will sag and get out of shape, and also will gradually burn away. After you have found the proper length, which can only be determined by experiment, the wire netting should be put on as a protection ; it will be necessary to cut it into strips and bend it to a half circle before tacking to place. It should be kept about two inches clear of the coil at all points. It will take two heaters of this kind to keep a 10 x 12 room of ordinary height at a good temperature, connected in parallel across the 52-volt secondary of the transformer. It would not be safe to connect heaters across the primary, the danger from shocks and the increased fire risk being too great, nor would it be practicable to run them from the exciter, as it has not got enough capacity. The heat is generated directly in the wire which carries the current. We do not think you will be much troubled with self-induction in a heater of this shape, difficulty being experienced only when the wire is confined in an iron case. Heaters built as above will require about a 40 ampere fuse wire for each ; they should be mounted 12 or 18 inches from the floor, so as to get a good circulation of air round them.

" C.K.B." writes : When gravity batteries are set up new, how long a time should elapse until they are in good working order, and how long should they last before renewing cleaning zincs, adding blue stone, etc. ? 2. Are the Crowfoot zincs called zinc electros? 3. Does a galvanometer register the strength of the battery, or simply show that there is a current on the line. The kind I speak of is simply a cheap compass on top of a small coil of wire. 3. Would circuit being open cause gravity battery to waste zincs, blue stone and strength of solution, more than if they were on circuit ? In testing specific gravity with a glass bulb affair, I think they call it a Hydrometer, should the bulb rest on the blue solution, or should it stand up on the whole solution ? What should it register ? When my battery was new it sank until the bulb was on the blue solution and the top of the glass tube was almost under the water.

Ans.—(1) A gravity battery is in shape to operate just as soon as set up, provided you have used zinc sulphate round the zinc, instead of water, and that your copper sulphate is a saturated solution. The time they will last depends very much on the service they perform and the temperature of the room; we would say under ordinary conditions from say 3 to 6 months. 2. Yes, the Crowfoot zincs are called zinc electrodes. 3. It really shows the presence or absence of current, but as the deflection is dependent on the current strength, and the external resistance being constant, the current strength varies with the voltage and resistance of the battery; it is under this condition of constant external resistance, a more or less reliable indication of the strength and condition of the battery. 4. The battery will last longer if closed through a circuit of moderately high resistance than if left on open circuit. The use of a hydrometer is scarcely necessary except you desire to be very exact; the battery ought to do good work if the zinc and copper plates are clean, the zinc sulphate solution weak and the copper sulphate saturated, extending about an inch above the copper plate. The solution can be kept saturated by keeping a few undissolved crystals of the bluestone always in the bottom of the jar.

"Fireman" : What is a surface blow off ?

Ans.—It is a cock or valve, usually used in connection with boilers, placed at or a little below the usual water level, with a mouth extending into the boiler of dished or pan shape, so as to easily collect all grease or scum floating on top of the water, which blows off into the outer air if the cock be opened. This surface blow off is, of course, in addition to the usual blow off valve, connected as nearly as possible to the lowest point in the boiler.

"Ambition" : What is the meaning of the terms consequent pole and salient pole.

Ans.—A salient pole is one whose magnetism is produced by one set of windings ; the flux through consequent poles is made up of two or more fluxes generated by two or more coils.

"Subscriber, Montreal" : Can you inform a reader (1) What is the action of the Wenhault interrupter when used in feeding Rhumkoff coils with A. C. ? (2) Why does platinum tip get burnt off electrode in interrupter so easily ?

Ans. : (1) The principle of this instrument is that the current flow produces a gas by decomposing the acid surrounding the electrode, this gas as soon as formed insulating the electrode and thus stopping the current flow. As soon as the current ceases the gas disappears and the circuit is closed, this cycle of operations repeating with great frequency. When used with alternating current the instrument has to be synchronized or tuned with the frequency of the circuit. (2) It is difficult to say why your platinum is burning away too quickly without seeing the instrument in question ; perhaps you are trying to operate too large a coil from it.

" E. S.," St. John, N. B. : In a communication received lately referring to two special makes of chain hoists, one is described as being capable of lifting the same load with the same energy in one half the time. Is this not contrary to well-known mechanical laws ?"

Ans. : The same load, by which we presume you mean the same weight through the same distance, moved in one-half the time, means that the actual power output is twice as large in the short time operation as in the other, and since the energy delivered to the two hoists is the same, this in turn means that the losses in the slower hoist are at least twice as great as those in the other, or in other words that its efficiency is not greater than 50 per cent. of the efficiency of the other one. From the above you will see that the statement in your question is true under certain conditions, but it is most extremely improbable that those conditions will ever be found in practice, because the efficiencies of all hoists manufactured by reputable houses, those of about the same capacities being compared together, will not vary more than a comparatively small percentage, a discrepancy of 10 per cent. being the very outside that one would expect to find.

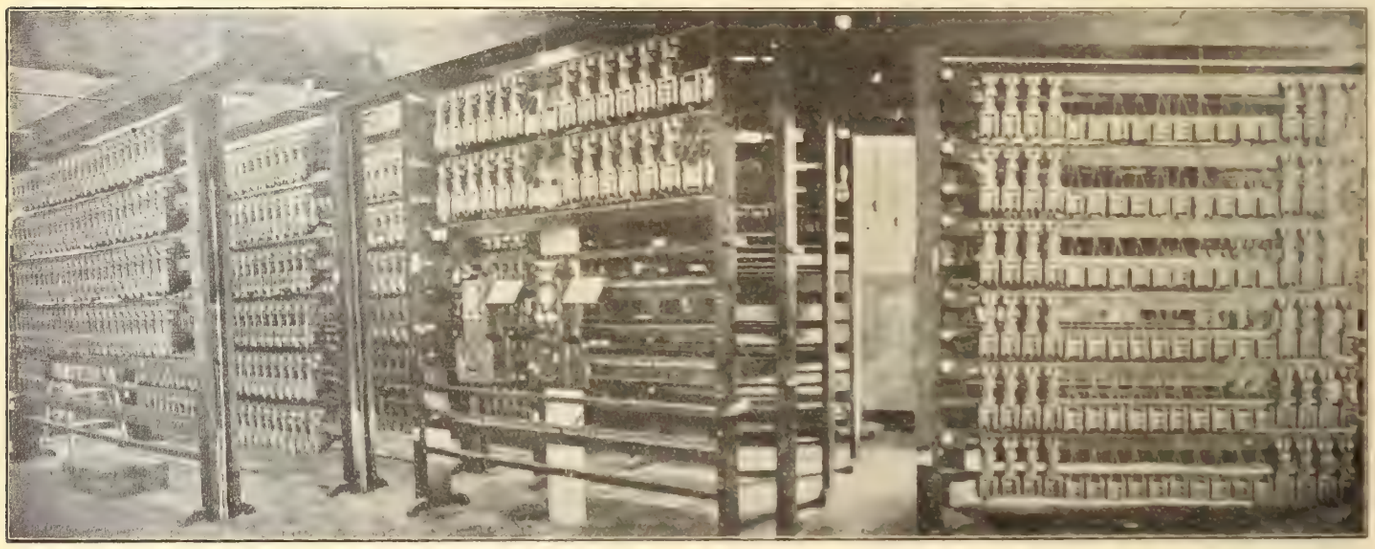
A SUCCESSFUL AUTOMATIC TELEPHONE EXCHANGE.

At Fall River, Mass., there is now in successful operation an automatic telephone exchange, using the Strowger system and handling the business of nearly 600 subscribers. The exchange, says the Electrical Review, was built by a local company under license from the Eastern Automatic Telephone Company, of Boston, and represents the most modern and complete installation of automatic telephones in the United States.

The difference between automatic exchanges and manually operated exchanges consists in the entire suppression, in the former, of the services of a third party in making connection between two subscribers. By automatic means any subscriber is enabled instantly to connect himself with any other and also automatically to disconnect both lines when his conversation is finished. By an ingenious application the calling subscriber is prevented from interfering with the line already in use and is notified that the called party is using his telephone. The method adopted to secure this result is one of extraordinary ingenuity and interest ; and while the complexity of the system is apparently very great, yet it is due simply to a multiplication of similar parts in themselves simple and, as has been proved in practice, reliable in their operation.

The system at Fall River comprises an exchange and a full metallic system of circuits to the subscribers distributed over a large portion of the city and its suburbs. The wiring from the exchange to these subscribers is carried out underground in twisted-pair cables of the "conference" standard, made by the Standard Underground Cable Company, of Pittsburg, and laid in conduits of the American Vitrified Company's type. In the outlying districts of the city the lines are overhead, of the usual construction, cables being carried on poles to distributing boxes and circuits run thence by aerial wires to the subscribers' premises. In its external details the wiring for this exchange is precisely similar to that for any metallic-circuit exchange system using a manual switchboard ; the difference is found in the subscribers' instruments and in the exchange itself.

The subscribers' station contains, besides the usual bells, transmitter, induction coil, battery and receiver, the selective calling apparatus, which is mounted in a box about the size of the usual telephone magneto. On the front of this box is a disc of metal, having along the edge on one side ten holes numbered consecutively from 1 to 0. By inserting the finger in one of these holes the disc may be turned, a stop placed at the lower part limiting the distance to which it may be turned with the finger in any given hole. To call a number the subscriber first removes the receiver from its hook and inserting his finger in turn in the holes of the proper number, turns the disc until his finger is stopped at the bottom, then releases it, and lets it go back to its starting position. Having turned up the proper numbers in this way he presses a button which rings the called subscriber's bell, and if the called line is not busy proceeds with his conversation. If the called line is busy, upon listening in his receiver, he hears a buzzing sound notifying him of this fact. Calling requires one second or less for each number.



FIRST SELECTORS. SECOND SELECTORS CONNECTING SELECTORS

FIG. 1.—THE AUTOMATIC TELEPHONE SWITCHBOARD AT FALL RIVER, MASSACHUSETTS, SHOWING FIRST, SECOND AND CONNECTING SELECTORS FOR A TOTAL OF 1,000 LINES, WITH 564 LINES CONNECTED AND IN SERVICE.

The operation of the calling device is very simple and will be explained below. The subscribers' lines entering the exchange terminate in the usual lightning arresters and heat coils and pass thence through a distributing rack to a bank of selectors shown in the first illustration. Each line is connected with one of the selector machines, which occupies a space of about four by five inches in plan and ten inches high. The selector switch consists of 100 contacts, ranged in ten rows of ten each, mounted on a semi-circular structure, occupying the axis of which is a vertical rod adapted to be moved vertically and rotated. Better to explain the system in use the method of connecting an exchange of 100 or less subscribers will be described first. In this case each subscriber's selector is connected with all the others. The first movement of the calling subscriber's step by step selecting disc, which he operates in calling, picks out the "ten" and the next movement the "unit," this being very simply

accomplished by sending in the first selective signal over one side of his two-wire circuit and the other signal over the other side, in both cases the ground being used as a return for the signaling current. Assume that the subscriber called is No. 63. The first movement to the figure 6 on the calling disc will result in stepping the vertical rod of his selector up six steps, or so that the wiping contact arm which it carries is opposite the beginning of the sixth row of contacts. The second movement to 3 will revolve the selector switch three steps, leaving the wiping contact on the third point on the sixth row and thus connecting the subscriber with telephone No. 63. This connection being accomplished, the caller pushes a button to ring the bell of the called subscriber and conversation proceeds. Should the latter, however, be already connected with some other telephone, then by a simple relay mechanism an interrupted battery current is thrown on the line of the calling subscriber, producing an unmistakable audible signal which informs him that the called line is busy. When the conversation is finished, hanging up the telephone of the caller sends current over both his lines and releases the step by step mechanism so that his selector on the switchboard goes back to its initial position ready for another call.

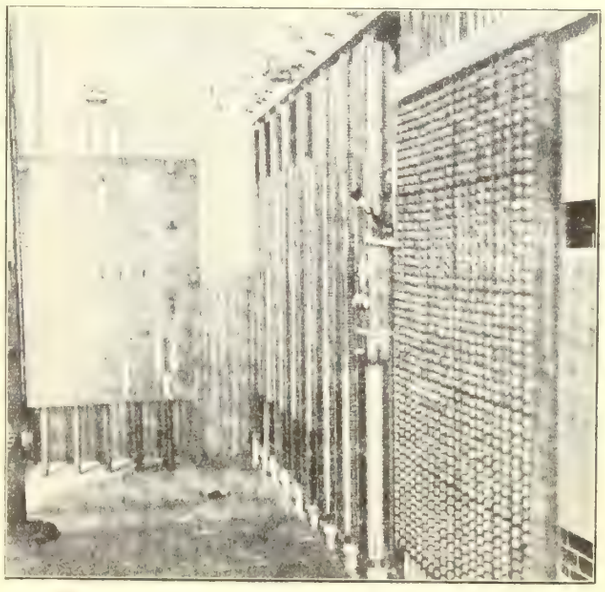
The extension of this system to an exchange having between 100 and 1,000 subscribers is exceedingly simple. In this case the first signal made instead of selecting the first digit of the called number directly connects the calling line to one of ten or more trunk lines, all of which lead to groups of instruments containing 100 in each. For example, if the number called is 546 the first signal sent in will pick out one of ten lines leading to the fifth group of 100 and the next two signals will select from this group the telephone number 46 in it, giving the desired call. For exchanges to have between 1,000 and 10,000 subscribers, as in Fall River, the first two signals pick out first the thousand group, then the hundred group in which the called number is found.

It has been found in practice that ten of these trunk lines are sufficient for each 100 subscribers, as the apparatus is automatically selective and proceeds to pick out a trunk line which is not busy, passing over those which are occupied without stopping. If none of the ten lines is in use the first signal sent in by a calling subscriber will stop on the first of the lines. If this happens to be in use the instrument automatically proceeds to the second one, and so until one line of the group not occupied is picked out. In the rare instance where all ten are busy, the result is simply that the calling subscriber gets the busy signal.

Current for operating all of the signalling mechanism and the bell ringing is generated at the central exchange in a battery of thirty storage cells, which are charged at convenient intervals through a battery-charging motor-dynamo from the local electricity supply mains. For working the selector signals, direct current of about 0.1 ampere is used, while for bell ringing an alternating current is provided by the usual motor-generator set. To attempt a detailed description of the numerous ingenious points of this system would carry this article beyond its limits, and reference can be made here only to a few of the salient features of the system.

It will be noted that all of the contacts employed, except the relay used in closing the bell ringing circuit through the called subscriber's line, are of the wipe-contact type, thus insuring good contact and minimizing the ill effects of dust and dirt. No conversation is ever carried on through an abutting contact, all of the contacts in the talking circuit being of the wire variety. Only two wires are run to each subscriber, and the apparatus for calling and signalling is of the central energy type, all of the current generating and converting devices being at the exchange where they are under supervision. The apparatus at the subscriber's station is no larger than that employed by other telephone systems.

The advantages claimed for this automatic system are numerous and important. Perhaps foremost is the rapidity and certainty with which connections may be made. In a test of numbers called at random at Fall River, made by a representative of the Electrical Review recently, the longest time required to ring the called subscriber's



Power Switchboard. Cable Terminal Board. Distributing Board.

Power, Terminal and Distributing Switchboards in the Fall River Automatic Telephone Exchange.

bell was seven and one-half seconds, while the average of a number of such calls fell below five seconds. Service like this is, to say the least, unusual. Another advantage that such a telephone system possesses is that it imposes the responsibility for a wrong connection upon the calling subscriber and puts in his hands, as it were, the mechanism of the exchange to work quickly or slowly, accurately or inaccurately, as he pleases. In this way a fruitful cause of complaint is abolished, while at the same time service is actually bettered. The secrecy of the service is, of course, a highly valuable feature, as is the impossibility of interruption or disconnection during a conversation.

From the point of view of the exchange itself the difference is even more marked, since the automatic system, while experience with it so far shows that the maintenance costs are practically the same as those for a manual exchange, saves the large fixed charge due to the wages of operators and attendants. In the Fall River exchange there are employed, in addition to the usual bookkeeper, collector, etc., only one attendant in the switchboard room, two inspectors and two line-

men, and these spend much of their time installing new telephones. During the night and on Sunday the exchange is locked up and left to take care of itself.

Referring to the illustrations it will be seen that the space occupied by apparatus competent to take care of 999 subscribers, at Fall River, is no larger than that required for even a cramped manual exchange of the same capacity, while no provision has to be made for retiring rooms, etc., such as are found in the usual telephone exchange. Two-thirds of the installed switchboard has a capacity for 2,700 lines, the other portion requiring only additional sections to complete the exchange of that number. By the use of the trunking system the number of connections necessary to make on the switchboard and to maintain in the central office has been reduced considerably below that required for a multiple switchboard, there being necessary for each subscriber's circuit only seven connections to be made when the apparatus is installed on the board. The other connections are made at the factory when the instruments are manufactured and are, of course, there made under conditions best adapted to ensure their permanence and reliability. As the large illustration shows, the connecting cables are run in wooden troughs over the racks carrying the selector mechanisms, this construction making an exceedingly neat and simple arrangement of the exchange wiring.

The exchange opened service in September, 1901, with 400 subscribers, the actual number connected on November 9, 1901, being 590. It has given great satisfaction to its subscribers, who speak unreservedly in praise of it. The company comprises among its stockholders many users of the system, and, so far as may be judged from an external inspection, has achieved a very full measure of success in the installation and operation of its most ingenious system.

ELECTRICITY DIRECT FROM HEAT.

By James Asher.

There are several methods of obtaining electricity from heat without the use of any working fluid such as steam or gas used in engines to drive dynamos.

The thermo-electric battery consists in a set of strips of either unlike metals or of alloys whose alternate junctions are heated while their opposite junctions are cooled. Mr. Tesla told the writer that it is impossible to obtain an efficiency of more than two per cent. from a thermo-electric battery. On another occasion he said that the low efficiency of the thermo-electric battery is not its greatest defect, but the fact that the junctions of the metals become greatly impaired. Mr. Cox invented a battery in which he claims that the latter objection has been overcome. During construction the elements are melted together.

A battery consisting in a set of iron cups containing carbons and caustic potash are set over a furnace. Experiments with this battery led many to believe that electricity could be generated with economy from the heat of burning coal. Mr. C. J. Reed made a number of experiments with this invention which satisfied him that it is really a thermo-electric battery.

A pyromagnetic generator was invented in 1887 by Mr. Edison. It consists in a number of horizontal field magnets whose poles point towards a vertical shaft. Facing the poles of the magnets are several compound vertical armature tubes of iron only one two-hundredth of an inch in thickness. The upper ends of the tubes are fastened in a thick iron disk, while their lower ends are fastened in a similar disk. The iron disks serve as pole pieces for the field magnets. The armatures are wound with insulated wire, which is led to a number of brushes, which press against a commutator. Instead of having two brushes and many commutator bars, this machine has many brushes and two commutator bars. The shaft bears a semi-circular disk of fireclay on its lower end. When rotated in a proper manner the disk successively screens the lower ends of the armature tubes from the upward passage of hot furnace gases. During the passage of hot furnace gases throughout the tubes these lose magnetism, but while their lower ends are screened they become cool and gain magnetism from the field magnets. The successive magnetizations and demagnetizations of the armatures cause the generation of electric currents in the wires wound on the armatures. The commutator arranges the currents so that a continuous current flows in the external circuit. The machine is mounted on a furnace which resembles a coal stove. Mr. Edison said that a pyromagnetic generator weighing two or three tons would supply thirty incandescent lights, each of sixteen candle power. In regard to economy he said that experiment proved the invention to be more economical than any other method of generating electricity.

POWER DIRECT FROM HEAT.

A pyromagnetic motor was invented by Mr. Edison in 1887. The largest machine weighs fifteen hundred pounds and yields about three-horse power. It has a horizontal bipolar field magnet between whose pole pieces are an armature composed of a great many iron tubes each only one two-hundredth of an inch in thickness. The armature has a vertical shaft. Two earthenware guides, one above the upper end, and the other below the lower end of the armature, guide cold air into and out of about one-half of the armature tubes. A broad segment of the armature is always being cooled, while the two outer segments are always being heated by hot furnace gases which are blown up through them. The cold air during its passage through the tubes, while cooling them, becomes raised in temperature. This air is led below the burning coal. By means of this regenerative device an economy in heat is effected. The earthenware guides are stationary and are dissymmetrically set in regard to the field magnet. The parts of the armature which are red hot refuse to carry magnetism, while the cooler part carries them freely. A distorted magnetic field is set up which causes rotation of the armature. This machine has the following faults:— 1. It is heavy. 2. The armature can run no faster than 120 revolutions a minute. 3. Alternate heating and cooling cause the failure of the thin iron tubes. 4. These narrow tubes are very liable to become clogged with soot and ashes.

Pyromagnetic motors and motor generators were invented by M. Menges, of the Hague, in Holland. His pyromagnet motor has a vertical shaft. Fastened near the armature ring, so as to rotate along with it, is a corrugated sheet iron ring. A group of gas jets is set at about 45 degrees from the middle of the pole piece of the permanent field magnet. Diametrically across the armature is a similar group of gas jets. The gas jets

heat successive parts of the thin iron annular screen while it and the armature rotate. The screen is cooled by two blasts of air diametrically across the armature from each other. The red hot parts of the screen permit the passage of very few lines of force, while the cool parts permit the passage of many lines of force from the field magnet to the armature. A distorted magnetic field is set up which causes rotation of the armature and the screen which it carries.

M. Menges' pyromagnetic motor generator is similar to his motor just described, but the armature has a gramme winding and there are brushes and a commutator. The field magnet is wound with wire, and the machine is self-exciting. Part of the current may excite the field magnet while part may supply electric lights. Part of the energy may at the same time be used to drive machinery directly connected to the shaft. Menges' machines have the faults of Edison's, except No. 4.

The motive power in pyromagnetic motors and motor generators is due to heat energy. Magnetism is used as a convenient means of transmitting energy from burning fuel to the armature.

POWER TRANSMISSION PLANT IN WASHINGTON.

In the generating station of the Walla Walla (Wash.) Gas and Electric Co. isinstalled the new dyro-electric plant illustrated herewith. The plant was put in operation in May last, and up to the present time, we understand, has given 24 hour service without interruption. The water is conducted from a near-by stream through a wooden stave pipe line, 5,600 feet long and four feet in internal diameter. The water wheel is 27 inches in diameter and is operated under a head of 90 feet. It is direct-connected by a friction clutch to a 300 kilowatt, monocycle generator. The wheel is a McCormick turbine, built by the S. Morgan Smith Company, of York, Pa., who furnished the hydraulic equipment. The electrical installation was made by the General Electric Company. Fig. 1 well shows the general arrangement of the power machinery. The generator is of the revolving-field type and is operated at 450 revolutions per minute. The end thrust of the wheel is taken care of by lignum vitae steps, one set in the wheel case and the other in the discharge pipe. The wheel is fitted with a Replogle relay governor, as shown in Fig. 2. At the left end of the driving shaft will be seen a wide-faced pulley which is connected to the generator by a friction clutch. This is to provide connection for a 400 horse power steam engine which is not shown in illustrations. The engine is installed only as auxiliary to be used in case of accident to the water power. The plant is situated five miles from centre of distribution.

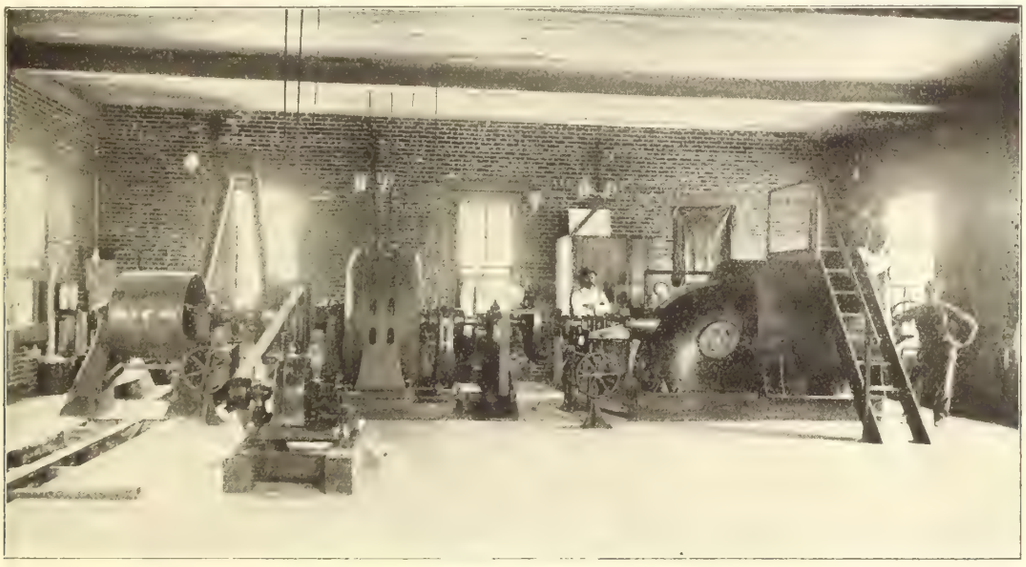


FIG. 1 POWER TRANSMISSION PLANT IN WASHINGTON.

The Royal Electric Company have notified the city council of Montreal that it is their intention to immediately replace the street lamps now in use with those as specified in the new contract. It is expected to replace one-half of the number now installed during the year 1902, and the remainder during the following year.

In 1897 the Citizens' Light & Power Company contracted for the street lighting for ten years of the municipality of St. Louis, a suburb of Montreal. In May, 1901, the council decided that the Citizens Light & Power Company was not furnishing a satisfactory light, and on this ground gave a 15 year contract to the Royal Electric Company. As a result the two systems have been in operation ever since, and the Citizens' Company have entered an action to secure the payment of $20,000 for light furnished for one year.



FIG. 2 POWER TRANSMISSION PLANT IN WASHINGTON.

MONTREAL

Branch office of the CANADIAN ELECTRICAL NEWS,
Imperial Building,

MONTREAL, January 6, 1902.

The Montreal Street Railway have at last relieved the pressure on the Windsor route by opening their recently well built line up Beaver Hall Hill, and running west on St. Catherine street. This is a capital business men's route and should be appreciated, especially as it is equipped with the long double truck cars, built on the Scotch plan, with the entrance in the centre. The hot air heating apparatus (another improvement over last year's coal stoves) is located near the motorman, but as it does not reach the rear section, this is heated electrically by radiators placed under the seats.

The Montreal Gas Company's metres and those of the Royal Electric Company are now being read by the same staff, one of the outcomes of the new Montreal light and power combine. The idea is certainly a very good one for the company, although it may have the result of dispensing with some employees who may now be found superfluous.

A lighting company, and an Ontario one at that, write a prominent one here as to their views on free wiring! Now, while this is well in its way, we would suggest that they not only "throw in" the wiring, but a Waterbury watch, or a pound of tea. As far as Montreal goes, with some 50 aspirants for wiring honors in the field, the lighting company don't seem to hanker for a business which is already so "fine" that it is hard to get three meals a day on the profits thereof.

The inspection, wiring and line superintendents of the Royal Electric Company have now all been removed from their former offices, corner Queen and Ottawa streets, to quarters in the Montreal Street Railway Building, whilst the clerical staff, treasurer, etc., have taken up their abode with the Montreal Gas Company in the New York Life Building.

The Christmas season could not be called a busy one locally in electrical circles. Supply men, wiring contractors, etc., were rather quiet, and the lighting companies could have stood a few more connections. Usually things flatten down for the winter after New Years, but this year has seen the date advanced by a fortnight.

Mr. J. Bell, the efficient and well-known inspector for the Canadian Fire Underwriters Association in Montreal, has resigned his position with that body, to accept a similar one under the Ottawa Fire Insurance Company, who, we are informed, are not in the Fire Underwriters Association. Mr. Bell's decisions as to alterations in existing installations were generally carefully considered, and those who have met him will wish him success in his new position and a wider scope of action electrically. By the way, Mr. Bell, take a glance for a change at "outside wiring and connections." You will find a rich field.

The Stanley "magnetic flotation" recording watt-meter adopted by the Royal Electric Company and later by the Lachine Company, seems to fill a long felt want apparently, as both companies are short of meters and awaiting the filling of their orders. It is said the Stanley Company have orders for 80,000 on hand. This seems scarcely credible, but even if approximate, the company must be doing a marvellous business, considering that it is virtually a new comer on the market—not to speak of the other specialties which they manufacture.

The accident on Chenneville street, in this city, reported lately, where "primary" wires came in contact with some "dead" secondaries, but which unfortunately were still connected with transformer, being only one tap of several secondary taps from same transformer, shows the necessity of the entire removal of service wires right back to mains (or transformer) when service is discontinued. It also teaches that all unlined sockets still existing in cellars with cement or earth floors should be at once eliminated. But for above circumstances the death of the furnace attendant who lost his life apparently through holding the socket and opening the furnace door at the same time with the other hand, might not have occurred.

A switchboard attendant named Lieper got himself severely burned on the side of the face and ear by an arc when opening a high tension switch (10,000 volts) lately at the Royal Electric Company's station. It is said there was a short-circuit on the line at the time, and Lieper went to open up the switch.

The apparent "scheme" of trying to influence the stock market by announcing a "deal" between the Lachine Company and the Montreal Light, Heat & Power Company as tried by a lay evening contemporary, proved a signal failure. Mr. Walbank, the managing director of the Lachine Company, not only promptly denied the statement, but added that the option of purchase on the basis of two dollars for every one dollar invested has expired, and the price will now be higher.

It is said that Mr. W. H. Browne, Montreal, late general manager of the Royal Electric Company, will go to Great Barrington Falls, Mass., to accept the position of manager for the Stanley Electrical Instrument Company. Mr. Browne was a prominent member of the Order of the Knights of Columbus when in Montreal.

It is rumoured that Mr. Hounald, of the Lachine Rapids Company, will shortly sever his connection with that company. The fraternity will be sorry to hear this, as Mr. Hounald is a general favorite. He has the satisfaction of knowing that the Montreal boys will miss him, but wish him every good luck in his new sphere where'er it chance to be.

PERSONAL.

Mr. Charles A. Henderson, of the B. Greening Wire Company, Hamilton, has completed the electrical engineering course in the American School of Correspondence, Boston, Mass., and has been awarded a diploma.

The marriage was celebrated last month of Mr. William F. McLaren, electrical engineer of Pittsburg, son of Lieut.-Col. Henry McLaren, of Hamilton, to Miss Houston, daughter of Ven. Archdeacon Houston, of Niagara Falls. Mr. and Mrs. McLaren will reside in Pittsburg.

Mr. H. P. Dwight, president and general manager of the Great Northwestern Telegraph Company, on December 23rd last celebrated the 73rd anniversary of his birth. From all points of the Dominion and the United States he was the recipient of telegrams and letters of congratulation.

In consequence of Mr. Hartley Gisborne having removed to Ladysmith, Vancouver Island, he has resigned the hon.-secretaryship for Canada of the Institution of Electrical Engineers, London, England. The council of the Institution has appointed Professor R. B. Owens (McGill University, Montreal) in his place. Mr. Gisborne succeeded Prof. Carus-Wilson as hon -secretary for Canada in 1897.

The following appointments have been made in connection with the management of the Montreal Street Railway and the Park and Island Railway: Mr. D. Robertson, assistant to the general manager; Mr. H. J. Kennedy, superintent of the road, with charge of traffic arrangements on both the Montreal and Park and Island systems; Mr. W. Punt, assistant superintendent and foreman of car shops at Hochelaga; Mr. H. R. Lockhart, superintendent of the power house and overhead-work on both systems; Mr. J. S. Vindin, engineer in charge of permanent ways, buildings and bridges; Mr. H. G. Taylor, mechanical superintendent.

We are pleased to learn of the appointment of Mr. O. P. St. John, of Toronto, as surveyor for the British Corporation for the Survey and Registering of Shipping. This corporation is a rival to the great Lloyds, of London, England, its purpose being to register and classify vessels so that they will be accepted as risks by the insurance companies. Mr. St. John will have charge of all vessels in the Great Lakes rated by this company. The British Corporation are fortunate in securing the services of Mr. St. John, as he is well versed in marine matters, and will doubtless look after their interests with entire satisfaction. He will, of course, continue to act as inspector for the Boiler Inspection and Insurance Company.

The town of Annapolis, N.S., will borrow $12,000 for the purpose of extending the electric light plant and operating it by water power.

Messrs. Downham & Hastings, electricians, have registered partnership in Montreal, as have also McDonald & Rivest, in the same business.

ENGINEERING and MECHANICS

TO FIND THE LENGTH OF BELT REQUIRED.

In a recent Wood-Worker an enquirer asked several questions concerning the duties of a millright. One of them was, how to find the proper length of a belt after the distance around the pulleys is known. If the pulleys are up the simplest way is to take a tape line and put it around the pulleys the same as you would the belt; whatever the tape reads that length your belt should be.

If you can not do this there is a simple rule to go by (for a straight belt). Suppose the distances between the centres of two shafts is 14 feet, the diameter of one pulley 8 feet and the other 4 feet, and the thickness of the belt ¼-inch. Then half the circumference of the 8-foot pulley is 12.5664 feet and half the circumference of the 4-foot pulley is 6.2834. Three times the thickness of the belt is ¾-inch or .0625 feet. Then 28 plus 12.5664 plus 6.2834 plus .0625 equals 46.9103, or 46 feet and 10 15/16 inches is the length of your belt. Therefore, the rule for a straight belt is this: To twice the distance between the two centres add half the circumference of each pulley, with three times the thickness of the belt.

To find the length of a cross belt the rule is more complex. First, the distance from the center of each pulley to the center of the point where they will cross must be obtained. If both pulleys should happen to be the same diameter, the cross will occur exactly in the center of the space between them. If not, then that point will be in proportion to their respective diameters and may be found by the following rule: Divide the diameter of the larger pulley by that of the smaller and add 1 to the quotient. This will represent the number of parts into which the distance between the centres is supposed to be divided. Then as the whole number of parts taken by the larger pulley, so is the whole distance between the centres to the point where the cross will occur. Example: A pulley 8 feet diameter is to drive one of 4 feet with a cross belt ¼-inch thick, the distance between the centres being 14 feet. Required, the distance to the point where they will cross and the whole length of the belt.

First find the point where they will cross by the foregoing rule: 8 divided by 4 equals 2, plus 1 equals 3. This represents that the 14 feet are supposed to be divided into three parts, and as the diameter of the same pulley is contained in that of the larger one twice, it shows that two parts of the three must be taken by it—3 is to 2 as 14 is to 9 feet 4 inches. Now, as the whole distance is 14 feet and the larger pulley requires 9 feet 4 inches, the distance from this point to the smaller pulley is 4 feet 8 inches, so that the distance from the center of the large pulley to the point where the belt will cross is 9 feet 4 inches, while the other from the same point will be 4 feet 8 inches.

If a horizontal line be drawn through the center of each pulley, extending from one to the other, and a perpendicular line also drawn through the same points, intersecting it at right angles, there will be two rightangled triangles formed, the base of one being 9 feet 4 inches, with a perpendicular equal to the radius of the 8-foot pulley, or 4 feet, while the other base will be equal to 4 feet 8 inches, with a perpendicular equal to the radius of the 4-foot pulley, or 2 feet, the belt in each case representing the hypothenuse; and as the square root of the sum of the squares of the base and the perpendicular of any right-angled triangle equals the hypothenuse, it is evident that the hypothenuse of these two figures must represent the length of belt between these two parts.

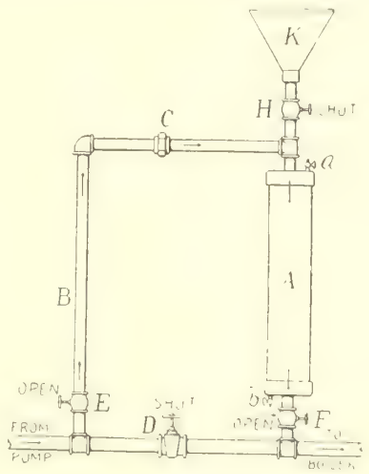
The operation perhaps will be more simple and easier understood if the whole be reduced to inches. Then 112 times 112 equals 12,544 inches, and 48 times 48 equals 2,304 inches, being the square of the base and perpendicular in inches. Then 12,544 plus 2,304 equals 14,848, the square root of which is 121.85 inches. With the other proceed in like manner: 56 times 56 equals 3,136, and 24 times 24 equals 576, and 3,136 plus 576 equals 3,712, the square root of which is 60.92 inches. Now if each of these sums is doubled and half the circumference of each pulley with three times the thickness of the belt be added together, their sum will be equal to the whole length of belt required in inches, which, when reduced to feet, will be found to equal 48 feet 11½ inches.

INTRODUCING SOLVENTS INTO BOILERS.

We are often asked by engineers and others how to introduce scale solvents, such as soda ash, into a boiler. We took up this question at some length in the issues of The Locomotive for July and August, 1888, when we showed two very convenient arrangements for pumping the dissolved solvent into the boiler, and also a method of introducing it by means of an injector. These different methods ordinarily work very well in practice, but we have occasionally had complaints to the effect that the soda ash, when passed through the pump, eats out the packing thereof. We think this would hardly be likely to occur with a new packing, but with an old one, which had become impregnated with oil or grease, the soda ash might easily give some such trouble as has been reported.

To assist those who have had difficulties of this sort, we present, herewith, another plan for introducing the dissolved solvent, by means of which it is forced into the boiler without passing through the pump at all. The present arrangement calls for more piping than the ones previously shown, and its only advantage is that it saves the pump.

Referring to the illustration, A is a section of big pipe—say 6 inches in diameter and 30 inches long—which is to serve as a reservoir. This connects with the feed pipe running from the



ARRANGEMENT OF PIPING FOR INTRODUCING SOLVENTS.

pump to the boiler, by means of the pipes B, C, and F, which are so arranged that they connect the feed pipe on opposite sides of the stop valve D. Over the reservoir is a funnel, K, by means of which the reservoir, A, can be filled through the valve H. The reservoir, A, is provided with pet-cocks, a and b, at the top and bottom, so that it may be readily filled and emptied. A union is provided at C, to facilitate the assembling of the piping. (A right-and-left elbow, of course, may be used instead, if it is preferred.)

The device is used as follows: The reservoir A being empty, valves E and F, and pet-cock b, are first closed, and valve H and pet-cock a are opened. The soda ash solution is then poured into K until the reservoir A is filled. The valve H and the pet-cock a are then closed, as well as the valve D, in the main pipe. Valves E and F are then opened, and the pump is started. The device is then in the condition shown in the engraving, and the water from the pump passes through B, C and A, as shown by the arrows, sweeping the contents of A out into the boiler.

When the pump has been run long enough to thoroughly remove all soda ash from A, valve D may be opened and valves E and F closed. The reservoir A is then emptied by opening pet-cock b and either pet-cock a or valve H, and the device is again ready for operation.—The Locomotive.

TORONTO NO 1, C. A. S. E.

The regular meeting of Toronto No. 1 was held on Wednesday, December 18th, president W. J. Webb in the chair. The meeting was thrown open, when Bro. A. M. Wickens, chairman of the Educational Committee, introduced Mr. Bigger, editor of the Canadian Engineer, who gave a talk on "The Metric System of Weights and Measures," after which the speaker was elected an honorary member of the association. Bro. C. Moseley and A. M. Wickens were elected representatives on the Technical School Board.

SPARKS.

The recent vote in Milton, Ont., on municipal control of electric lighting was 118 for and 39 against.

A new switch-board has been installed in the central office of the Bell Telephone Company at Toronto Junction, Ont.

The Hudson's Bay Company have recently added another combination engine and motor to the electric plant in their Winnipeg stores. Other improvements are being made.

A by-law was defeated by the ratepayers of Hagersville, Ont., on January 6th, to provide a municipal electric lighting plant.

It is said that the Lachine Rapids Hydraulic & Land Company, of Montreal, will issue bonds for $1,500,000 with which to erect a new steam plant.

Major Armstrong, of Toronto Junction, is advocating the extension of the Toronto Suburban Railway to connect with the Metropolitan Railway at Yonge street. He thinks that this would be the means of building up a large market for farm produce at Toronto Junction.

The Crescent Electric Company, of Montreal, has been incorporated, with a capital of $100,000, to install electric light plants and do a general electrical business. The charter members include Messrs. L. Rousseau, of St. Louis, and Maurice Rousseau, of Montmagny, Que.

The Cape Breton Electric Company are about to commence the erection of their new power house at Sydney, N.S. It will be 61 x 100 feet, so designed as to be enlarged to three times this size. There will be a car barn 80 x 160 feet. One thousand horse power in engines will be installed primarily.

The Phoenix Oil Company, of Cleveland, Ohio, manufacturers and dealers in lubricating oils, graphite greases, etc., have opened Canadian offices at Room 25, Janes Building, corner King and Yonge streets, Toronto. This firm make a specialty of Murphy's famous Green Seal belt dressing. Mr. P. R. Hood is manager and Canadian representative.

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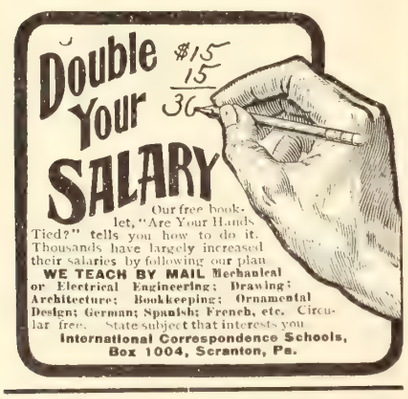
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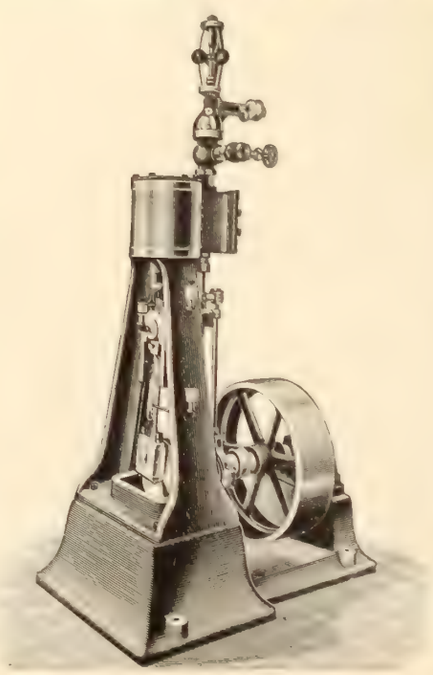
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THE DODGE COMPANY'S NEW PLANT.

The Dodge Manufacturing Company, Limited, of Toronto, have just completed what may be termed a model plant. The new building consists of a machine shop 200 x 75 feet; foundry, 125 x 75 feet, with annex; two storey office building, 60 x 40 feet. The buildings are of modern type, solid brick, with monitor roofs. Both machine shops and foundry are equipped with ten ton, three-motor travelling cranes and industrial narrow gauge rails and turntables. Among the massive machine tools installed in the machine shop is a 62 x 62 x20-foot planer, and a 16-foot boring and turning mill weighing in the vicinity of 40 tons. In the foundry a modern Whiting cupola has been installed.

The shops are heated with the Webster system of steam heating, lighted with both incandescent and arc lights, and electric power is used throughout. The electric light and power is generated on the premises by means of a 15 x 14 high speed engine, direct connected to a 100 kilowatt generator.

The office building is of handsome design, pressed brick and stone, the ground floor being used for the company's general offices, and the first floor as engineering and draughting rooms.

The entire plant covers some six acres. It is located on Pelham avenue, Toronto Junction, just north of the C.P.R. tracks and without the city limits. A system of railroad sidings encircles the plant, giving the company their iron, coke, coal, sand, etc., direct from car to stores. The new machine shops and foundry are employed altogether in manufacturing the Dodge Company's special lines of power transmission machinery. Their extensive wood pulley plant has also been materially improved. The company have a daily manufacturing capacity of 300 wood pulleys, apart from their iron pulley output. Over 1,000,000 feet of lumber is carried, and a new brick dry kiln of 60,000 feet capacity has been built. The Dodge Company extend an invitation to the trade to call and inspect their new works.

The city sales office and warerooms of the Dodge Manufacturing Company are situated at 74 York street, Toronto, where a large stock is carried.

WESTINGHOUSE GENERATORS.

The generators and other electrical apparatus installed in the power house of the Pittsburg Reduction Company at Shawinigan Falls, Que., to which reference was made in our last issue, were manufactured and installed by the Westinghouse Electric & Manufacturing Company, of Pittsburg, Pa., who have furnished a large quantity of electrical apparatus in connection with the development at Shawinigan Falls.

SPARKS.

Mr. Fletcher, who recently sold out his electric light business at Gravenhurst, has purchased a plant at Shelbourne, Ont.

The new Wheelock engine installed at the electric light power house is giving good satisfaction to Mr. Welsh and to those taking the light, which is now first-class. The engine, which has a stroke of 38 inches, drives a belt wheel 13 feet in diameter. The machine is beautiful in construction, and though capable of 200 horse power, works with the steadiness of a sewing machine.—"Hensall Observer."

A provincial order-in-council has been signed granting the Vancouver Power Company the right to 5,000 inches of water from the Coquitlam and Trout Lakes. This company is working in conjunction with the British Columbia Electric Railway Company, the object being to install a generating plant at Coquitlam for the purpose of supplying light and power to the cities of Vancouver and New Westminster. The initial installation will be 5,000 horse power, which will be capable of being increased to 15,000 h. p. Coquitlam Lake is fifteen miles from Vancouver. In connection with the scheme a tunnel two miles long will be built. Although the details of the project have not been announced, it is likely that the steam stations of the British Columbia Electric Railway Company in Vancouver and Burnaby will be used as anxiliaries.

FOR SALE.

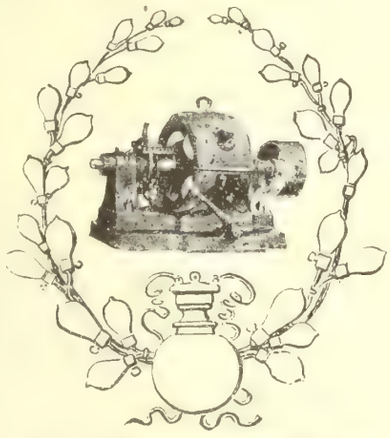
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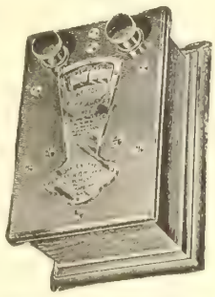
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THE EVERETT-MOORE DIFFICULTIES.

The affairs of the Everett-Moore syndicate, controlling a number of electric railways in Ohio, Michigan and Ontario, as well as a number of telephone lines, were placed in the hands of a receiver on January 2nd, as a result of the temporary financial embarrassment on the part of the syndicate, which has for some time been affected by the stringency in the money market. The syndicate is accredited with controlling 1,200 miles of electric lines, including the Cleveland Electric Railway Company, Detroit United Railway Company, Toledo Railway & Light Company and the Lake Shore Electric Railroad Company. The syndicate is also interested in the Street Railway at London, Ont. Mr. H. A. Everett, one of the members of the syndicate, is well-known in Canadian railway circles. He took hold of the Montreal Street Railway about ten years ago and converted it from a horse car system into an up-to-date electric road. He afterwards became manager of the Toronto Street Railway. No statement of the affairs of the company has as yet been given out. The difficulty is regarded by some as a victory for the Bell Telephone Company, whose hostility the syndicate incurred by operating independent telephone lines.

SPARKS.

Ottawa, Ont., has carried a by-law in favor of a municipal system of telephones.

The ratepayers of Newcastle, N. B., have voted funds for an electric light system.

The town council of Bedford, Que., have decided to light the streets by electricity.

The vote on the by-law to raise $30,000 for improvements to the gas and electric light plants of Brockville, Ont., will take place on February 3rd.

The Hamilton Suburban Electric Railway Company is seeking a charter to construct electric railway lines from Hamilton to Waterloo and Guelph, and from Galt to Guelph.

Nelson, B. C., has defeated a by-law to raise $150,000 to extend the civic electric light system.

The by-law to provide $15,000 for extension of electric light plant was defeated by the ratepayers of Niagara Falls, Ont.

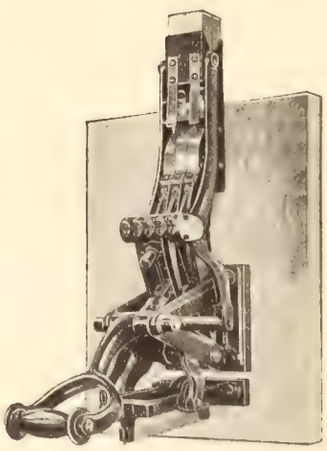
The Bell Telephone Company have given notice that at the the next session of the Dominion Parliament they will apply for an amendment to their charter giving authority for an increase of the capital stock. A similtar amendment was introduced last session but without success.

No less a project than an electric railway between Toronto and Cornwall is contemplated by the Ontario Electric Company, which has asked for incorporation. The distance between the two cities is 260 miles. Sir Richard Cartwright, of Ottawa, Cornelius Birmingham, of Kingston, and George E. Smith, electrician, of Boston, are associated with the enterprise.

The Petrolia Rapid Railway Company have made application to the town council of Petrolia, Ont., for the sole right to construct and operate a single iron or steel railway through the streets of that town, the intention being to use electric power. The promoters include G. R. Lovejoy, of Lennox, State of Michigan; John Harold, of Moore Township; and S. A. Armstrong, of Sarnia, Ont. The ratepayers will vote on the question on January 6th.

The new civic lighting and pumping plant for the city of Hull, Que., will be completed about February 1st. The power house is a fire-proof building, built of stone, with iron roof and concrete floors. The power canal is 2,500 feet in length, extending from the Ottawa river to the new power house. The intake pipe is built of three inch concrete, is 30 inches in diameter and 2,000 feet in length. It was constructed under the supervision of Mr. R. W. Farley, C.E., and is said to have cost less than half that of a steel or iron pipe. The pipe extending under the river, 500 feet in length, is of steel. There is one 35 inch horizontal trump wheel, developing 200 horse power, which will operate a 100 light arc machine for street lighting, while another machine may be installed at a later date.

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SPARKS.

An electric railway to connect Winnipeg with Headingly, Man., is spoken of.

Messrs. H. Brown & Sons have purchased the water power and saw mills of the Canada Lumber Company at Carleton Place, Ont. It is said to be the intention of the purchasers to develop the water power.

The Gress Falls Company, of Three Rivers, Que., is seeking incorporation, with a capital of $500,000, to conduct a general manufacturing business at Three Rivers and to transmit electric power. Messrs. Warren Curtis, of New York, F. P. Farmer, of Three Rivers, and L. H. Davidson, K. C., of Montreal, are among the incorporators.

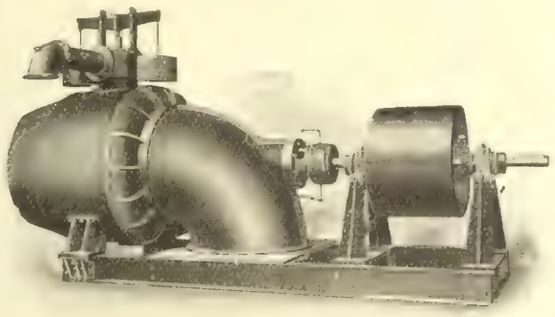
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During the recent holiday season the hardy linemen of the Great Northwestern Telegraph Company, to the number of eighty, gave tangible expression of their regard for their chief, Mr. A. B. Smith, superintendent of construction, by presenting him with a handsome gold watch and chain. To Mrs. Smith they gave a cabinet of silver, and to both a beautifully illuminated address which contains many kindly expressions of appreciation and good-will. The presentation took place at Mr. Smith's residence, Mr. Charles Charlebois, foreman at Toronto, being spokesman. After Mr. Smith had recovered some what from his surprise and expressed in feeling terms his appreciation of the kindly spirit which prompted the gifts, the deputation partook of refreshments and enjoyed an hour of pleasant social intercourse.

SPARKS.

The Bell Telephone Company's franchise in Ottawa expires in 1903, and a movement is on foot to secure the establishment of a service owned by the corporation.

Mr. R. Fielding has made a proposition to supply the town of Gravenhurst, Ont., with a system of electric lighting and waterworks for a period of twenty-five years.

The Quaker Oats Company have acquired a controlling interest in the Peterborough Light & Power Company, and it is understood that improvements to the plant of the latter company will be made at once.

Mr. Charles H. Mitchell, civil and hydraulic engineer, of Niagara Falls, Ont., is preparing plans for the hydraulic and electrical development to be undertaken by Mr. Joseph Knox, of Stayner, on the Nottawasaga river.

Mr. G. A. Welland, of Duluth, was recently in Parry Sound, Ont., with a view of arranging with the Anglo-American Copper Mining Company for the erection on their property of one of the new Hatch electric smelters so as to permit of the treating of copper ores there.

A stated case for submission to a single High Court judge has been agreed upon by the city of Toronto and the Bell Telephone Company in respect to the rights of the company upon the streets of the city.

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Day of Month.	Light.		Extinguish.		No. of Hours.
		H.M.		H.M.	H.M.
1....	P.M.	5.40	P.M.	3.40	10.00
2....	"	5.40	"	4.40	11.00
3....	"	5.40	"	5.40	12.20
4....	"	5.40	"	6.00	12.10
5....	"	5.50	"	6.00	12.10
6....	"	5.50	"	6.00	12.10
7....	"	5.50	"	6.00	12.10
8....	"	5.50	"	6.00	12.10
9....	"	5.50	"	6.00	12.10
10....	"	5.50	"	6.00	12.10
11....	"	5.50	"	6.00	12.10
12....	"	5.50	"	6.00	12.10
13....	"	10.00	"	6.00	8.00
14....	"	11.00	"	6.00	7.00
16....	"	0.15	"	6.00	5.45
17 ...	"	1.15	"	6.00	4.45
18....	"	2.15	"	6.00	3.45
19...	"	3.00	"	6.00	3.00
20....	"	3.45	"	6.00	2.15
21...	No Light.		No Light.		
22....					
23....	A.M.	6.20	A.M.	8.45	2.25
24....	"	6.20	"	9.45	3.25
25....	"	6.20	"	10.45	4.25
26....	"	6.20	"	11.45	5.25
27....	"	6.20	"	0.40	6.20
28....	"	6.20	"	1.20	7.00
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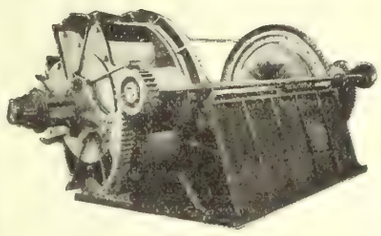
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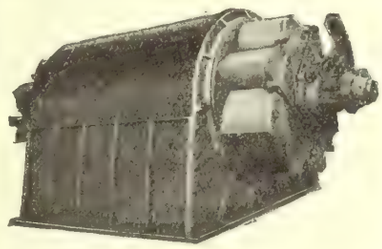
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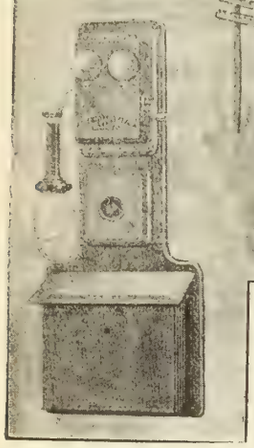
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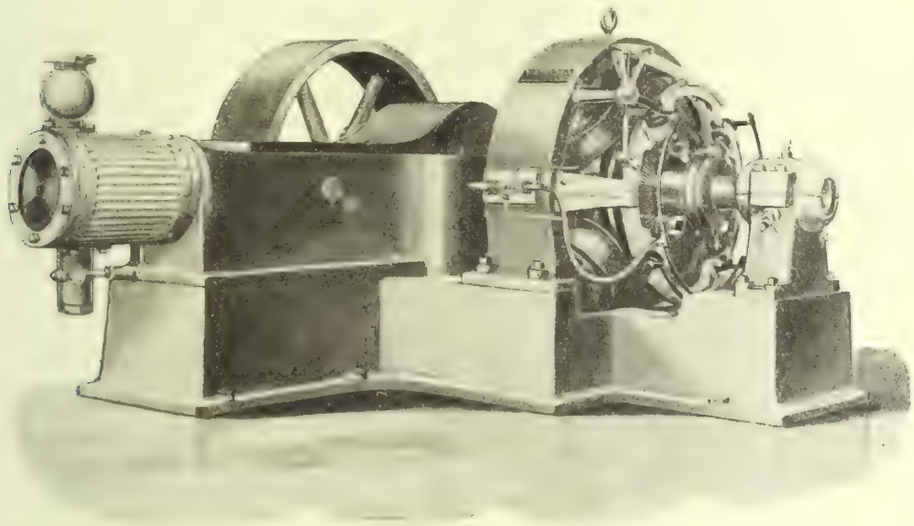
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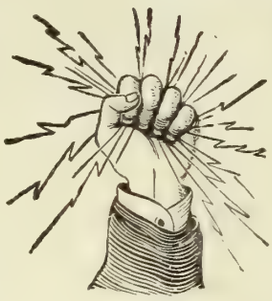
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AGENTS: { *William McKay, 19 McKenzie Crescent, Toronto.* *Watson Jack & Co., 7 St. Helen St., Montreal.*

SPARKS.

James Osmond, a lineman employed by the Ottawa Electric Company, was killed on January 30th by coming in contact with a live wire.

The city council of Montreal have granted the Montreal Terminal Railway Company a franchise to enter the city and construct a single line. The franchise is for five years.

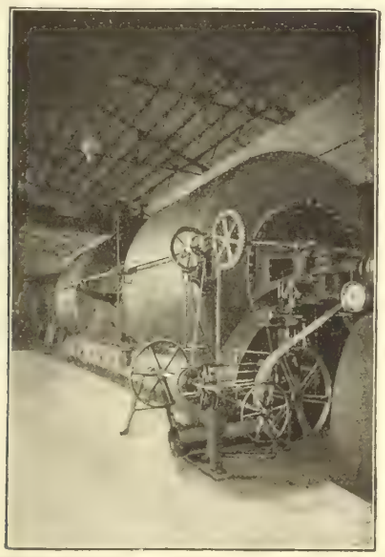
Mr. Ernest A. Thompson, representing the Westinghouse Company, of Pittsburg, Pa., will apply to the Manitoba Legislature for the incorporation of the Suburban Rapid Transit Company, to build an electric railway from Winnipeg to Headingly.

Mr. F. W. Martin, manager of the Lincoln Electric Light & Power Company, St. Catharines, Ont., recently returned from a visit to Cleveland, where he investigated a new system of arc lighting. The system may be adopted by the Lincoln Electric Light & Power Company.

The Berlin & Bridgeport Electric Railway Company elected the following officers in Berlin last month: President, W. H. Breithaupt; vice-president, Peter Shirk, Bridgeport; secretary, Alex. Miller, K.C. It is said to be the intention of the company to build the road this year.

Mr. Charles Chamberlain, of Winnipeg, announces that he has completed arrangements with New York capitalists to develop 100,000 horse power on the Winnipeg river, 65 miles from the city of Winnipeg, and to build gigantic pulp and paper mills. The intention is to transmit power to Winnipeg.

According to the statement presented at the annual meeting of the Ottawa Railway Company, the number of passengerscarried last year was 7,188,781, an increase of 100,000 over the previous year. The following officers for the ensuing year were elected: President, T. Ahearn; vice-president, P. Whelan; secretary, J. D. Fraser; directors, G. B. Brophy, W. Y. Soper, T. Workman, A. Lumsden and Hon. G. A. Cox.



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WRITE FOR CATALOG. DEPARTMENT E.

TRADE NOTES.

The Jones Underfeed Stoker Co., of Toronto, have issued an attractive calendar with illustrations of their fuel saving device and buildings and boiler rooms in which it is in operation.

Mr. David Sleeth, of Montreal, Canadian agent for Lord's boiler compound, has sent out a useful calendar, on the upper part of which are cuts, reproduced from photographs, showing the destructive influence of certain kinds of water upon steam boilers, and suggesting the necessity for the use of solvents.

The Cataract Power and Conduit Company, of Niagara Falls, has recently awarded to the Westinghouse Electric & Manufacturing Company a contract for seven 2500 h. p., oil-insulated, water-cooled transformers. These transformers will be wound for 2200 volts two-phase to 1100 or 2200 volts three-phase, and will duplicate the present equipment in the transformer house at Niagara Falls.

The Westinghouse Mfg. Company, of Pittsburg, have been given the contract to supply the electrical equipment for the large Portland cement factory now in course of erection at Durham, Ont. A representative of the Westinghouse Company is authority for the statement that the output of the works at Pittsburg has doubled within the last four years, and that delivery of goods cannot be promised within a less period than four or five months. The company make it a rule, however, to make deliveries when promised.

The Smart-Eby Machine Company, Limited, of Hamilton, have recently executed the following orders : Shafting, pulleys, etc., for the Times Printing Company ; set of Rogers patent shaking and dumping grate bars for W. T. Gibson, Grimsby ; centrifugal pump for W. H. C. Mussen & Company, Montreal ; 50 h. p. boiler for the Hamilton Public Library ; 8 x 10 vertical engine for the Durham Rubber Company, Bowmanville ; duplex pump for the Canadian Rand Drill Company, Sherbrooke, Que. ; sets of Rogers patent shaking and dumping grate bars for the Canada Preserving Company and the T. Upton Canning Company, Hamilton ; automatic feed pumps and receivers for the Hamilton Electric Light & Cataract Power Company ; 6x6 vertical engine for the London Engine & Supplies Company ; 5-ton travelling crane for the Waterloo Manufacturing Company, Waterloo, a repeat order ; shafting, pulleys, etc., for the Canada Radiator Company, Port Hope ; shafting, hangers, etc., for the Imperial Cotton Company.

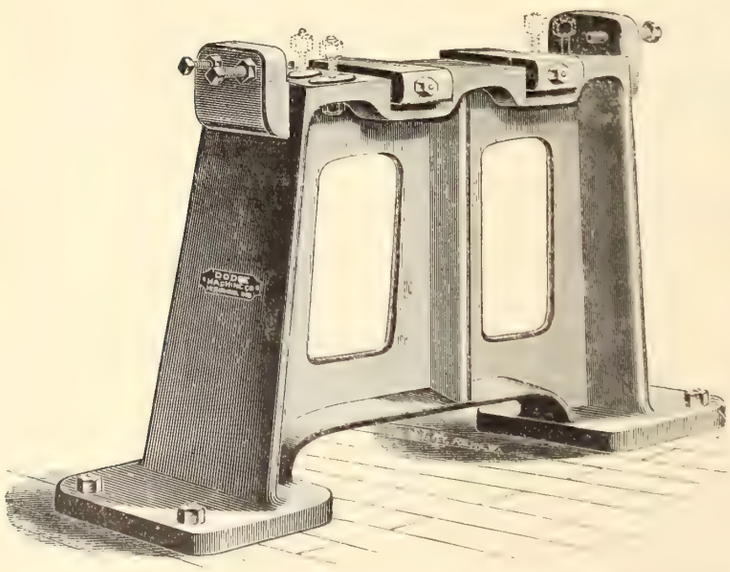
The Richmondt Conduit & Manufacturing Company, Limited, have installed a large plant for the manufacture of conduit, junction boxes, insulators, underground conduit which is electrolysis proof, and other electrical specialties in their line. Mr. Richmondt having sold his interest in the United States to the American Interior Conduit Company, saw that there was a field for a plant of this kind in Canada, the old company having shipped goods into Canada for several years. Mr. Richmondt is general manager and personally superintends the manufacture of everything in the factory. He claims that this industry will fill a long felt want in the electrical line. The Toronto city sales office and factory are at 15, 17 and 19 Jarvis street. The company have a manufacturing capacity of about fifteen thousand feet of conduit daily.

The following orders have recently been booked by the Smart-Eby Machine Company, Limited, of Hamilton : Howell Lithographing Company, Hamilton, shafting, pulleys, etc., to equip their new premises ; Hamilton Facing Mills, for tumbling barrels ; Corporation of Saltfleet, electrically driven centrifugal pump ; Malcolm & Souter, vertical engine for driving a fan ; Gurney-Tilden Company, Hamilton, shafting, hangers, etc., for their new building ; Holywood Paint Company, Hamilton, two twin color mixers ; Beardmore & Company, Toronto, one duplex liquor pump ; Canada Preserving Company, Hamilton, boiler feed pump ; Fowler's Canadian Company, Hamilton, duplex pump ; Pure Milk Syndicate, Hamilton, 60 h. p. boiler and 30 h. p. engine, with feed water heater, etc. ; Creamery Package Manufacturing Company, Chicago, one duplex pump and steel brine tank ; Dominion Lumber Company, Toronto, one 16x9x12 underwriter's fire pump.

The ratepayers of Brockville, Ont., on February 3rd approved of a by-law to raise the sum of $50,000 for improvements to the gas and electric light plants.

JACK SHAFT EQUIPMENTS

For Electric Light and Power Plants.



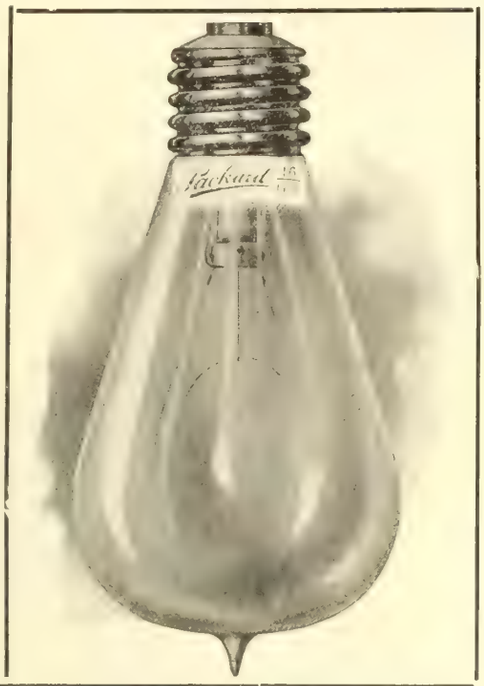
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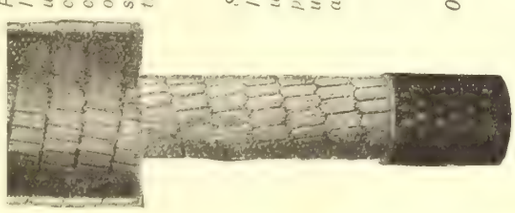
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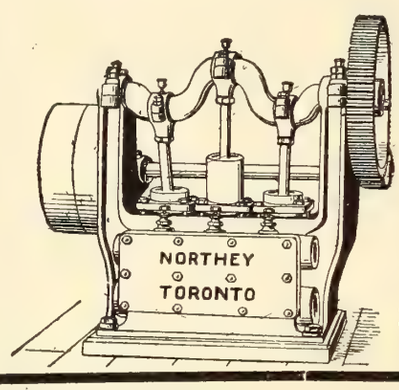
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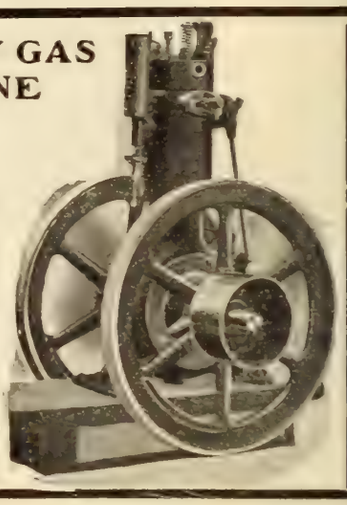
We manufacture pumps of every description—for all purposes. Our pumps are standard in Canada for excellent service.

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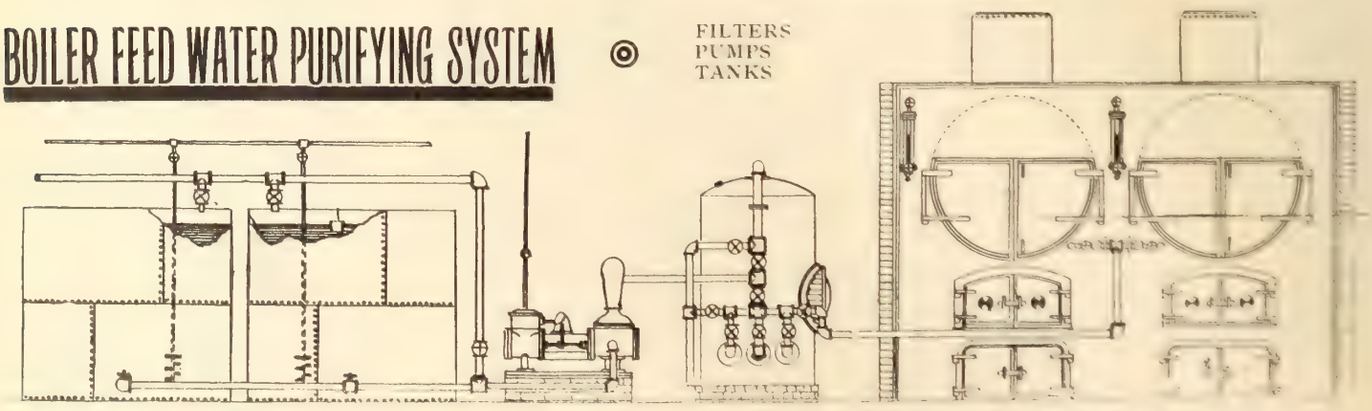
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ELECTRICAL NEWS

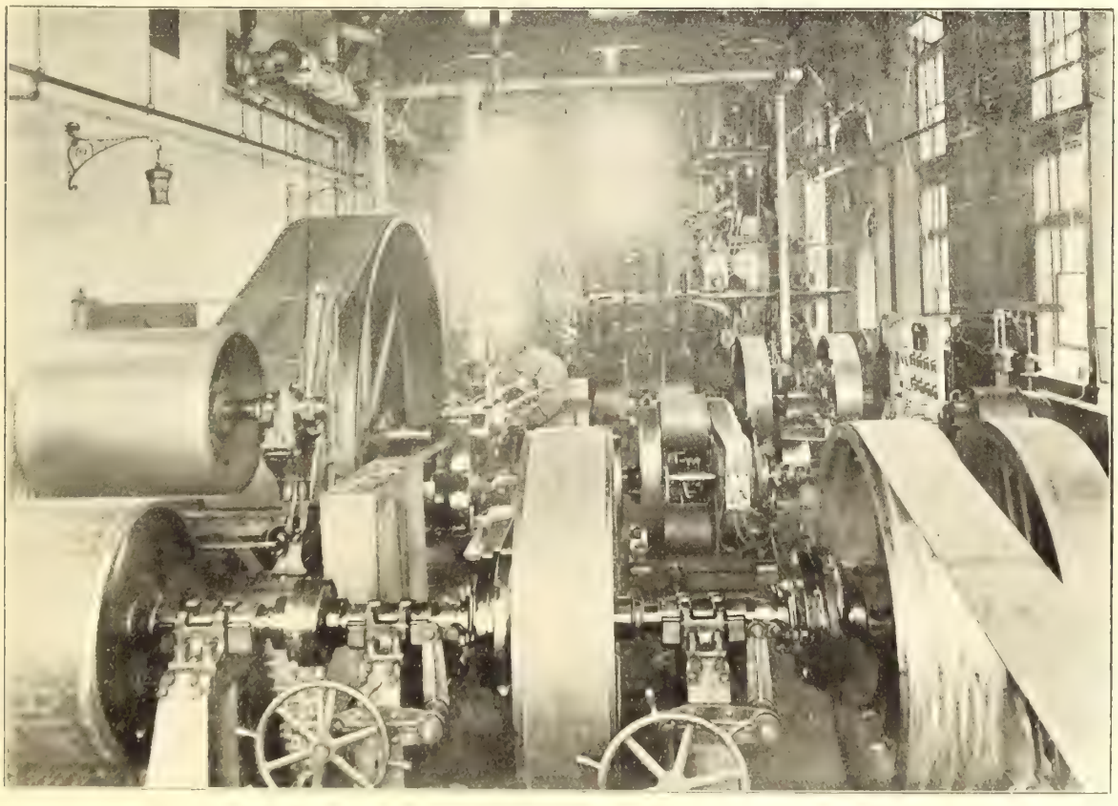
AND

ENGINEERING JURNAL.

VOL. XII. FEBRUARY, 1902 NO. 2.

WINNIPEG LIGHTING AND PUMPING PLANT.

In the summer of 1899 a municipal plant for electric street lighting and for pumping purposes was installed by the corporation of Winnipeg, under the supervision of Mr. James Stuart, Water and Light Commissioner. The electric light plant and waterworks pumps are located in one building, shown on the following page, which is a stone structure 94 feet long, 36 feet wide, and 26 feet high clear inside, the pumps being located in the north end and only taking up about 25 feet of the length of the building. The balance of the floor space is occupied by the electric light plant. The boiler house is 61 feet long and 32 feet wide, with a brick chimney 125 feet in height.



INTERIOR OF POWER HOUSE WINNIPEG LIGHTING AND PUMPING PLANT.

The steam plant consists of five Babcock & Wilcox sectional water tube boilers in two batteries of two boilers each and one of one boiler, having a rated capacity of 130 h. p. each, or 650 h. p. combined, at a steam pressure of 125 lbs. per square inch, with a total heating surface of 7,500 square feet and a total grate surface of 150 square feet. They are fitted with mechanical grates and stokers, which are driven by two 6 in. x 6 in. vertical engines. Water is supplied by two duplex Worthington pumps 6 in. x 6 in. x 7 in., and passes through a Bonner live steam feed water purifier before entering the boilers.

The power for electric lighting is derived from one pair of Brown automatic, horizontal, cross-compound surface condensing engines built by the Polson Iron Company, of Toronto, with Northey independent air and circulating pumps. The sizes of engine cylinders are, high pressure 18 inches diameter, low pressure 32 inches diameter and 42 inch stroke, operating at 80 revolutions per minute. The fly wheel, which is the driving pulley of the engine, is cast in two halves, is 16 feet in diameter and 44 inch face, carrying a belt 42 inches wide which drives a steel centre shaft 6 inches in diameter and 8 feet long, to which is coupled a steel shaft 5 inches in diameter and 20 feet long. The main driven pulley on centre shaft is 4 feet in diameter and 44 inch face. There is also an adjustable belt

tightener fitted with self-oiling bearings. The line shaft is fitted with four split, iron centre, friction clutch pulleys 60 inches diameter and 16 inch face, capable of handling 100 h. p. each. The bearings are of the adjustable ring-oiling type. All shafting, pulleys,

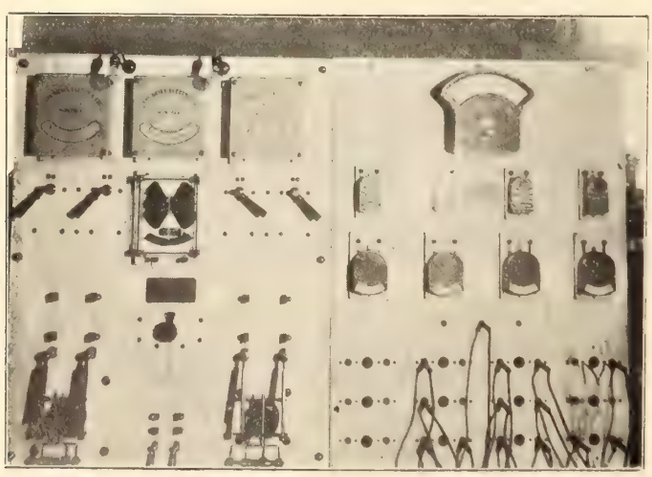


Power House, Winnipeg Lighting and Pumping Plant.

bearings, etc., were furnished and installed by the Dodge Manufacturing Company, of Toronto, and have given perfect satisfaction.

Three of these pulleys are belted to three Western Electric arc dynamos, each having a capacity of 100 open arc lamps with a maximum output of 9.6 amperes and 5,800 volts operated at a speed of 650 revolutions per minute. The switch-board is of marble, bolted together through angle iron, which is fastened to the floor and wall in a substantial manner. The construction of this switch-board is such that the dynamos may be changed to any circuit or vice versa while the machines are in operation. Each dynamo circuit is supplied with an ammeter and polarity indicator. There is also one volt-meter suitable for indicating the voltage of any circuit. Each line is equipped with two single pole lightning arresters.

The street lamps are of the Western Electric Company's single carbon type. There are 240 in opera-



Incandescent Switch-Board. Arc Switch-Board.

tion and they give a steady and uniform light. They are provided with automatic cut-outs which switch the lamps out of circuit when the carbon becomes consumed or when the arc for any reason becomes too long.

Current is also furnished from this station for lighting all municipal buildings by one 60 kilowatt S. K. C. two-phase, alternating current generator, the switch-board for which is of marble and is equipped with two current indicators, one volt-meter and transfer switch, one volt-meter transformer, one ground detector, two main line switches, one exciter switch, one generator rheostat, one exciter rheostat, four magazine fuse blocks and two pilot lamps. The alternator is driven by a pulley on line shaft operated by large engines, but during moonlight can be operated by one Leonard Ball tandem compound, condensing, high-speed engine. The buildings lighted are the city hall, north, south and central fire halls, market building, police station, store houses and waterworks. The total number of lights installed is about 750.

The operation of the waterworks and electric light plant is combined, the boilers furnishing steam for both electric light and pumping engines.

The pumps in use are one set of Worthington compound, condensing, vertical pumping engines with a capacity of 5,000,000 gallons per 24 hours at 30 lbs. pressure per square inch on main. The engines pump



Mr. James Stuart.
Water and Light Commissioner, Winnipeg.

the water from an artesian well and deliver it to the water softening plant, from which the water flows into a reservoir and is pumped from there to the city by one set of Worthington duplex, triple expansion, surface condensing, vertical pumping engines with a capacity of 5,000,000 gallons per day at 125 lbs. pressure per square inch on main.

A curious circumstance illustrating the difference in speed between sound, which travels through the air, and electricity through wire as its guide and conductor, occurred in California. A certain powder works blew up in a town while a railway telegraph operator was telegraphing to another in a neighboring town. At the instant of the occurrence he telegraphed the news to the operator, who, sixty seconds afterward heard the report of the explosion. He knew it had occurred by wire just one minute before he heard the report. Sound travels at about the rate of 1,140 feet per second, while electricity accomplishes 186,000 miles in the same short period of time.—Exchange.

VISIT TO THE CORNWALL POWER PLANT.

Upon the invitation of Messrs. Collyer & Brock, of Montreal, Canadian agents for the Bullock Electric Manufacturing Company, Cincinnati, Ohio, a large number of interested persons visited the power plant of the St. Lawrence Power Company at Cornwall, Ont., on January 11th. The party were carried by special G. T. R. train from Montreal to Cornwall, where, after a thorough inspection of the plant, luncheon was partaken of. The electrical apparatus for this important power development was furnished by the Bullock Electric Manufacturing Company. A description of the plant will appear in our next number.

CAUSES OF LOSS OF CURRENT.

OTTAWA, ONT., Jan. 8, 1902.

Editor CANADIAN ELECTRICAL NEWS:

SIR,—Replying to your letter of 3rd inst. and post card of 4th, with reference to meters, we beg to say that our experience has been entirely different from what appears to have been that of the electric light inspection department.

It is a rare exception for a meter to be brought in after having been used on a customer's premises a considerable time and not to find it running slow, especially on small loads. Our meters are tested and carefully adjusted before they are sent up to the government for inspection, in order to save paying fees for nothing, consequently the inspector finds them correct, with very few exceptions. I do not see how it can be otherwise, except with small companies who do not adjust meters at all, but depend upon the government inspector to tell them when meters are wrong, and even then I should think there would be a preponderance of slow meters. In comparing notes with other companies, I have always found their experience to be similar to ours as to slow meters. It would be interesting to know what the actual figures were from which the electric light inspection department compiled the records which led to their statement.

Yours very truly,

A. A. DION,
General Superintendent Ottawa Electric Company.

SHERBROOKE, QUE., Jan. 6th, 1901.

Editor CANADIAN ELECTRICAL NEWS

Sir,—Your letter of the 3rd to hand. Would say that it would entail quite a bit of labour for us to make a record of the difference between the station and the consumer, seeing we have no meter in the station, simply our common instruments on the switchboard. We have also quite a few customers on flat rates and many other difficulties which I believe other companies have, and I don't see how any company can keep or make such comparison.

With regard to meters found to run fast when tested, I believe a few of the Shallenberger which we used two years ago were found to be on the fast side but passed. The meters we now use, the Stanley watt meter, is exactly right every time, and after two years hard use, are found to be the same as when tested. I believe the general run of meters are set at first to run fast, as they soon get slow enough, but that is the exception with the Stanley meter, it keeps exactly right in our experience. We have now in our small works about 250 of them, and everyone has been correct when tested. I may say that the companies who put out meters generally make them on the fast side. As I was led to believe when on a visit to several works in the States last fall, it was with the view of making up for the lagging or slow going which soon appeared in the meters—after a few weeks' use. I trust you will not imagine that I am an agent for the Stanley meter, but I simply give my experience, and also the experience of several electric companies in the New England States who are now using them and have been for two years—putting out several other makes. The inspectors I believe will find in that meter an instrument which will show a good record, and will I believe make a more correct showing for those companies whose difference is so much between the station and the customer.

Yours very truly,

A. SANGSTER,
Superintendent Sherbrooke Gas & Water Company.

TORONTO, January 9th, 1902.

Editor CANADIAN ELECTRICAL NEWS.

Sir,—I have yours of January 3rd., referring to the statement in the Electrical World that electric lighting companies in the States are only able to deliver from 60 to 68% of their energy as generated to their customers. Taking the majority of plants I should suppose that this is not an excessive statement. It is altogether likely that the theoretical efficiency of even a first class plant under most favorable conditions would involve a loss of at least 15% in line resistance and the various converting devices, but when you consider that nine-tenths of the time an electric lighting plant is working under uneconomical conditions, that is to say, with generators and transformers very much under full load and during the whole time when a plant is in operation, whether any current is being delivered to customers or not, the loss on the transformers is just the same.

If a new plant is put in on the best modern lines with everything up to date and properly calculated for the amount of work it is to do, the loss would not be any more than as above stated. Most plants, however, are the product of a gradual growth and the machinery, lines and transformers have been added to from time to time, as occasion has arisen, and very often in a temporary manner. Nothing but a complete rebuilding of the plant, involving the destruction of the original investment, and a complete new outfit, would bring some of these stations up to full efficiency, and it is a great question whether in most cases the interest on the cost of this new outfit would not be more than the loss by the uneconomical working of the old. In some cases it might be, but it is altogether a question of local conditions and the circumstances under which plants are operating.

With reference to meters: I am perfectly satisfied that more meters run slow than run fast, and that the loss from this source is considerable. There is also a considerable leakage and loss where the company's lines extend over a large area and run into buildings where there are a number of tenants who constitute a floating population and also a certain amount that the companies are cheated out of by dishonest customers.

I think the reason that the Government Inspector finds more meters fast than slow, amongst those that are sent to him by the customer for re-verification, is that this is the result of outside parties' interference with the meters, who make approximate tests and only select those meters for re-verification which are found to be fast. When they find slow meters, or when the customers have reason to believe their meters are slow, they do not shout very loudly.

Yours truly,

J. J. WRIGHT,
Manager Toronto Electric Light Co.



VISITORS TO THE POWER PLANT OF THE ST. LAWRENCE POWER COMPANY, CORNWALL, ONT., JANUARY 11TH, 1902.

MR. WM. H. BROWNE.

The Montreal daily press brings us the information that Mr. Wm. H. Browne, who for the past seven years was General Manager of the Royal Electric Company, has severed his connection with them, taking effect January 31st, 1902, and was elected a member of the Board of Directors of the Stanley Electric Instrument Company, of Great Barrington, Mass., and at a subsequent meeting appointed General Manager and Treasurer, his term of office beginning February 1st, 1902.

Mr. Browne's connection with the electrical industries is rather unique, and dates back to 1888, when he built the electric railway in Richmond, Virginia, which, if not the very first, was one of the first electric railways in the United States, and on which much of the pioneer electric railway work and experimenting was done. Following this he became associated with the Westinghouse interests in New York City, and as General Manager of the United Electric Company, was in charge when the first alternating current, high tension generators—2000 volts—were installed, and the distribution of light from them began. At that period it was considered murderous to install systems of such high potential, and many are the curious yarns he can regale his friends with as to the awful consequences predicted from their use.



Mr. Wm. H. Browne.

Curiously, from New York his next move was to Montreal, to the Royal Electric Company, where one of his first moves was the changing of the entire lighting system from 1200 volts to 2400 volts, and the installation of a polyphase system of current for power and lighting purposes, both of which were very radical departures, at the time, from what was then considered good practice, but which is in almost universal use now.

The Chambly Manufacturing Company about this time, 1897, began the development of the hydraulic power on the Richelieu river at Chambly Rapids for the purpose of transmitting the power to Montreal by electricity, a distance of about 16 miles. Here the novel feature of generating within the machines 12,000 volts, so that step-up transformers were not necessary, was for the first time put in practice and successfully carried through. Although later on changed to a lower voltage and step-up transformers, yet the example set in this work is being carried out in the largest power generating and distributing plants in this country and the United States, where it is a common practice now to generate a pressure of 6,600 volts.

The following year the company completed the works of the Cataract Power Company, of Hamilton, who are carrying 10,000 H. P. nearly 40 miles, at a pressure of 24,000 volts, which was at the time of its installation the largest transmission and the highest voltage in practical use in North America, if not in the world.

The past year was spent in Montreal, the principal event being the turning over to the Canadian General Electric Company, of the manufacturing business of the Royal Electric Company, which was built up under Mr. Browne's careful management, and which is now being actively carried on by the first named company.

The consolidation or community of interest between the Chambly Manufacturing Company, the Royal Electric Company and the Montreal Gas Company, under the name and title of the Montreal Light, Heat and Power Company, with a capitalization of $25,000,000, was his last work in Canada, and completed the largest industrial organization in the Dominion.

It seems but fitting that, having been in the van since 1888, the latest and most radical departure in electrical engineering devices should be captained by him, and we most heartily wish that prosperity shall continue with him in his new position, and his every effort be crowned with success.

While Mr. Browne was at the fore and front, and progresive in business matters, and while we may miss his leadership, yet more will he be missed among those who had the pleasure of knowing and coming in contact with him personally. Genial, broad-minded and fair, he was a friend to everybody, and once met never to be forgotten. His connection with the Canadian Electrical Association during his residence in Canada was the most active, serving two years as President, and made him friends innumerable, and though he may never meet with us again, his works will live after him, and his hearty laugh and genial good fellowship will ever live in the memory of those who knew him.

Mr. J. Laine has transferred to the Belgian Syndicate, of Shawinigan Falls, his franchise for an electric railway from Three Rivers to that place.

QUESTIONS AND ANSWERS

"Induction": (1) A three-phase generator has its rating as follows: 400 k. w., 382 amperes volts, no load 550 volts, full load 605. Step-up and step-down transformers are in use which step from 550 to 11,620 at the generating station, and 11,000 to 575 at sub-station. In order to receive 575 at sub-station the generator need only be run at 525 volts. Are we loading generator at full load capacity when we get 382 amperes at 525 volts, or may it be run at 525 volts till the output represents 400,000 watts? Give formula for calculating three-phase systems. (2) How can I make a volt-meter from 10 to 125 volts suitable for D. C. dynamo? What changes would be necessary to use it on A. C. at the same voltage?

Ans.: (1) The kilowatt output of your machine when run at 382 amp. and 525 volts is not, of course, the rated capacity of 400 k. w., but the heating due to the current load is the same as if the voltage were at its highest point of 605, but, since it will not require as much field current to give 525 volts as it will 605, the heating of the field and consequently of the machine as a whole will be slightly less under the lower voltage; or in other words, you may increase your load in amperes slightly, if you keep your voltage at 525, and get the same heating as with the normal current of 382 amperes at 605 volts. The current in a three-phase system is obtained by multiplying the single-phase current by .577, the k.w. by multiplying the single-phase k. w. by 1.732, or current $= \frac{577 \text{ kilowatts.}}{\text{voltage}}$

Kilowatts = current × voltage × 1.732. (2) It is not practicable for you to make a commercial instrument; it would cost you far less and be much more accurate if bought from a standard manufacturer. We presume you have one on your 500 volt alternator; if operated either through a potential transformer or an external resistance it could be connected to your direct current voltage which you want to measure by means of a small double throw switch.

"Anxious to Know," Montreal, writes: Would you kindly explain in your next issue how an induction motor may be made to work as a generator?

Ans.: You will have to drive it up to speed by some external source similar to any other generator, and then excite it by coupling it up with some other source of alternating E. M. F. It will not give any voltage, no matter at what speed it is driven, unless connected as above to an alternator.

"J. C.," Montreal, writes: Where was the first telephone exchange established in Canada?

Ans.: In a paper entitled "History of the Telephone in Canada," read before the Canadian Electrical Association in 1893, by Mr. L. B. McFarlane, we are told that Prof. Alex. Graham Bell, the inventor of the telephone, lived at Tutello Heights, on the outskirts of Brantford, Ontario, and it was there that his earliest experiments in telephony were made. The first experimental line erected in Canada extended from the residence of the inventor's father to the residence of Rev. Thomas Henderson in Brantford. The first commercial telephone line was established at Hamilton, Ont., in October, 1877, by the District Telephone Company, connecting together the residences of Messrs. Baker and Cory. Subsequently a number of private lines were erected in Montreal and Toronto. These lines formed the neuclus of exchanges in these cities which were first put into operation in 1878.

"C. D. M.," Sussex, N.B., writes: (1) Can you give me the actual or approximate cost per thousand gallons of water pumped up into a reservoir? Our pump is a simple, duplex, Worthington, capacity 2.25 gallons per minute. The reservoir is half a mile away on a hill. We pump direct into mains, the pressure at the station being 82 pounds, and when pump is running about 84 pounds. We have an 80 h.p. boiler, three inch tubes, bricked in, of Leonard make. Our coal costs in boiler house $3.50 per ton. (2) Please explain as fully as possible how Signor Marconi sends messages from one station to another through the air without wires.

Ans.: It is not possible to give anything but an approximate answer to your question, except by making an actual test. It must also be borne in mind that the figures given below cover nothing but the bare cost of the coal, such items as labor, depreciation and interest on investment not being included. A square inch of water 1 foot high weighs .433 lbs. Therefore a pressure of 84 lbs. per square inch gives a height or lift of $\frac{84}{.433}$ feet. A U. S. standard gallon of water weighs $8\frac{1}{3}$ lbs. Therefore, the foot minute lbs. output of pump is $8\frac{1}{3}$ (lbs) × $2\frac{1}{4}$ (gallons per minute) × $\frac{284}{.433}$ (feet lift) and the horse power is $\frac{8\frac{1}{3} \times 2\frac{1}{4} \times 84}{.433}$ 33,000 h.p.

Pumping at $2\frac{1}{4}$ gallons per minute, your pump will take $\frac{1,000}{2\frac{1}{4} \times 60}$ hours to pump 1,000 gallons. Therefore, the horse power hours necessary to deliver 1,000 galls. under 84 lbs. pressure is $8\frac{1}{3} \times 2\frac{1}{4} \times \frac{84}{.433} \times \frac{1,000}{2\frac{1}{4} \times 60}$ 33,000

A pump such as yours, in combination with a boiler of ordinary efficiency, will produce a horse power hour on 12 to 18 lbs of coal, or say 15 lbs. Therefore, to produce the above horse power hours your pump will consume

$$8\tfrac{1}{3} \times 2\tfrac{1}{2} + \frac{84}{.433} \times \frac{1,000}{2\frac{1}{4} \times 60} \times 15 \text{ lbs. of coal.}$$

33,000

Since 2,000 lbs of coal cost $3.50 cents, the above number of pounds will cost

$$8\tfrac{1}{3} \times 2\tfrac{1}{4} \times \frac{84}{.433} \times \frac{1,000}{2\frac{1}{4} \times 60} \times 15 \times \frac{350}{2,000} \text{ cents.}$$

33,000

which equation resolved gives about $2\frac{1}{4}$ cents as the theoretical cost of the coal alone, obviously an extremely small percentage of the total, and utterly negligible among the other items of the cost. (2) It is difficult without going into a very long article to give you much information on this subject, but in brief the principle part of the apparatus consists of an instrument, called a coherer, which has the ability to receive or perceive the disturbances or waves produced in the air or ether surrounding the earth, by the passage of a spark between the terminals of an ordinary spark gap or induction machine. The high poles used at each end are for the purpose of giving to and receiving from the air the greatest amount of disturbance, or number of waves, that is possible. The coherer consists of a glass tube containing filings of various substances, iron and nickel being most commonly used, these filings being in circuit with a battery and a relay similar to those for ordinary telephone and telegraph work. Under ordinary conditions the resistance of this coherer is so great that no current will pass through it, but when a discharge from the sending instrument comes down the pole wire and through the filings they rearrange themselves so as to lessen their resistance enough to let a current from the battery pass through and operate the relay, which in turn operates some form of sounder or tape machine. The relay is so arranged that it mechanically taps the tube at the instant of operation; this parts the filings and they then assume their original position, ready for another discharge or signal. Mr. Marconi uses the standard Morse code of dots and dashes. A popular article on wireless telegraphy appeared in a recent issue of Maclure's magazine.

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EDITOR'S ANNOUNCEMENTS.

Correspondence is invited upon all topics coming legitimately within the scope of this journal.

The "Canadian Electrical News" has been appointed the official paper of the Canadian Electrical Association.

Electricity v Acetylene.

The town of Lindsay has recently given a ten years contract for street lighting by acetylene gas. The acetylene company have laid down pipes on the principal thoroughfares, and undertaken to supply 125 lights of 150 c.p. each at the rate of $15.00 per lamp per year, and 6 1,500 c.p. lights at $35.00, at which figures it is believed they will be unable to realize a fair margin of profit. This is believed to be the largest acetylene plant in operation in Canada, and the results will be watched with interest. The citizens appear to be finding out, in the lignt of the competition of the new company, that the prices which they have been called on to pay in the past for electric light have been reasonable. It does not seem probable that acetylene will supplant the electric light for commercial purposes, but may possibly tend to show up to better advantage the superior quality and adaptability of electric light over acetylene gas as an illuminant.

Loss of Current.

A WRITER in the Electrical World states that in the United States electric light companies are only able to deliver to their customers from 60 to 68 per cent of the initial energy developed at their stations. The remaining 32 to 40 per cent. is said to be lost in transmission and in transformers and meters. Twenty-five per cent. of this loss is said to be chargeable to slow running meters. In view of the importance of this matter, from a financial point of view, to electric lighting companies, request was made of the managers of several companies in the cities and larger towns in Canada for a statement of their experience in this direction. Some of the replies received are printed in the present number. The subject is one which will bear further discussion, and a comparison of experience on the part of managers of companies, would doubtless bring out information that would be helpful to all. We therefore invite a further expression of opinion from electric light and power companies. Current costs money to produce and is the stock in trade of the central station manager. Loss of current is not only a direct loss of money spent for fuel and equipment, but also stands in the way of the development of electric lighting, the cost of which could be lessened and its popularity increased if loss of current could be prevented to a larger extent than at present.

The Extension of Foreign Trade.

THE suggestions made by a committee of the Canadian Manufacturers' Association to the Dominion Government regarding the extension of export trade should be heartily supported by Canadian manufacturers and the Canadian press. We may not all agree as to the particular methods to be adopted, but the necessity of taking steps to make our manufactured products better known in foreign countries must be universally admitted. The markets of the West Indies, for instance, are now very largely supplied by United States merchants. Very little is known of Canadian goods. It is claimed that New York houses already handle more Canadian goods in the West Indies than are shipped direct from Canada. The publishers of this journal recently received from a gentlemen at Hamilton, Bermuda, a request for a directory of Canadian wood-working firms and dealers in building material. This gentleman states that for materials for public works they are compelled to obtain estimates from the United States on account of not knowing where to apply in Canada. He adds that the Imperial Government Surveyor had applied to him for such a directory, and he was certain that such information would often lead to the placing of considerable orders that now go to the United States.

Toronto's Municipal Enterprises.

There is reason to fear that the scheme to empower the city of Toronto to develop and distribute power for electrical purposes and to enter into arrangements with outside companies for that object, is the work of shrewd promoters who are naturally enough seeking to make their pile by a short cut, and that efforts are being made to induce the city's representatives to lend their support not altogether from the standpoint of custodians of the public funds. Some three or four years ago, the town of Austin, Texas, went into a power development scheme, with the result that the town is now bankrupt, and unable to pay for ether gas, water, or electric light. Toronto has also engaged in several undertakings, which though less disastrous, must be classed as failures, and which have saddled heavy and unnecessary burdens on the taxpapers. Under this head might be cited the Don improvement scheme on which three quarters of a million dollars were wasted; the alternative site for the C.P.R. on the esplanade which cost nearly a million and which is bringing the city no revenue and serving no useful purpose; the new city hall which was to have cost $750,000 and will actually cost at least $2,500,000; and the St. Lawrence market, which has already cost $50,000 above the limit of expenditure fixed when the by-law was submitted to the property owners for their approval, which

when completed will only represent a part of the original scheme, and which seems likely to fail of its object, as the lesses of the old market refuse to move so far away from their present location. These and other undertakings are costly examples of municipal mismanagement, and give no encouragement to prudent property owners to allow themselves to be taxed for further experiments of a similar character. We have the peculiar spectacle of the chief promoter of the present scheme in the Council, urging the purchase by the city of the property of the gas company, and saying that gas is the coming thing, while on the other hand seeking to induce the city to become a stockholder in outside companies to develop and supply electricity. The city would not have a controlling interest in such companies and would therefore be dependent on their willingness to grant satisfactory terms.

Electric Lighting Companies vs. Municipal Corporations

A legal decision of much interest and importance to electric lighting companies is printed in this number of the ELECTRICAL NEWS. The case is one of an action brought by the corporation of the town of Rat Portage, Ont., against the Citizens' Telephone & Electric Company of that town, to have declared invalid a contract entered into by the corporation with the company for the supply of light, fire alarm service, etc. The corporation entered into a five years' renewable agreement with the company in 1899. The Council passed a resolution authorizing the acting mayor, in the absence of the mayor, to sign the agreement, and at a subsequent meeting, owing to the power of the acting mayor to sign the contract binding the corporation having been called in question, passed a second resolution confirming its previous action, and the acting mayor's right to sign the agreement in behalf of the corporation. As a condition of giving the contract to the company, the Council stipulated that the campany should forego payment of $50 per month for fire alarm service from 1st December, 1898, to the 11th of September, 1899. To this condition the company agreed. On making the agreement with the company, the corporation refunded the amount of $1,000 deposited by the company with their tender. For two years the company served the corporation under the agreement, and was paid for the service at the contract price, the amount so paid being included in the municipal estimates. At this stage the Council, seemingly as the result of personal animus against the company on the part of some of its members, brought action to set aside the agreement with the company on the ground that it was invalid, because no by-law authorizing it had passed the Council. Judge Britton, before whom the case was argued at Port Arthur, decided that, in view of the circumstances, the passing of a by-law was not necessary to make the agreement binding on the municipality. He declared that the acting mayor who signed the agreement for the corporation was vested with all the powers of the mayor, and that the Council, by passing resolutions confirming the agreement, as well as by levying a special rate and paying the company for the service in accordance with the terms of the contract, clearly acquiesced in the agreement. He further pointed out that the corporation had made a good bargain with the company and had received advantages which were acceded to by the company only on the understanding that the agreement should cover a period of five years and be renewable. On this understanding the company had also invested a large amount in new plant. It would therefore be manifestly unjust to the company to allow the agreement to be broken. We have heard a great deal during the last few years about the unjust treatment of municipalities by private corporations, but very little has been said on the other side of the question. The facts in the case under consideration are a strong evidence that, in some instances at least, there is a deplorable lack of honor on the part of municipal councils in their dealings with private corporations. While it is desirable that electric lighting companies should endeavor to work harmoniously with the Councils, there is necessity for the exercise of caution, especially with regard to terms of contracts, as is plainly evidenced by the experience of the Rat Portage company.

CANADIAN ELECTRICAL ASSOCIATION.

A meeting of the Executive Committee of the Association to make preliminary arrangements for the Annual Convention, was held at the Windsor Hotel in Montreal on the 10th of January. There was a full attendance. Mr. P. G. Gossler, President, presided. A number of new members were elected. It was decided that the Annual Convention should take place in Quebec on June 11th, 12th and 13th. Various Committees were appointed to carry out the necessary arrangements for the meeting.

A letter was read from Mr. Frederic Nicholls, General Manager of the Canadian General Electric Company, offering the sum of $500.00 to the Association to be applied as the Executive Committee might direct.

The Committee accepted the offer with thanks, and decided that the money should be set aside as a special fund, out of which will be allotted yearly a sum not exceeding $75.00, to be awarded in prizes by a Committee to be appointed for that purpose each year, to the author of a statement of his latest original investigation or development of the electrical art, or for paper or papers presented to the Annual Convention, which statement of original investigation so presented to the Annual Convention, or paper or papers, shall, in the opinion of the Committee to be appointed annually to judge thereof, be considered the most worthy and valuable of the series presented at such Convention. Such prizes to be awarded only to members of the Canadian Electrical Association.

A Committee was appointed to decide upon rules and regulations under which the prizes for papers should be awarded, and to the Committee on Papers was delegated the duty of judging the merits of papers submitted.

The President was requested to communicate with Mr. Francisco and ask that he include Canada in his statistics of the results of the operation of municipal plants.

Having learned of the presence in Montreal of Mr. Marconi, the Committee tendered that gentleman an invitation to an informal luncheon at the St. James' Club. Mr. Marconi very kindly accepted, and the Committee spent a couple of hours very pleasantly and profitably in his company.

Mr. Marconi has intimated his intention to attend, if possible, the Annual Convention of the Association at Quebec in June next, and to present at the Convention a paper embodying the results of his most recent scientific researches.

POWER AND ITS ECONOMICAL TRANSMISSION.

The important subject of "Power and its Economical Transmission" was discussed in an able manner by Mr. Henry Souther, consulting metallurgical engineer and state chemist, of Hartford, Conn., in a lecture delivered in the rotunda of the Board of Trade Building, Toronto, on January 16th, under the auspices of the Canadian Manufacturers' Association. Having the benefit of both practical and theoretical experience, Mr. Souther may be regarded as an authority on the subject. He treated briefly with the generation of power and then in more detail on sub-divisions. His remarks in part are given below:

Naturally the first thing to consider in connection with the subject before us is the source of power in an industrial establishment, and to determine the best source of power the only basis of comparison in these commercial days is that of cost.

The only power we can obtain for practically nothing is that from falling water. The cost of harnessing is considerable, but after that there is nothing to compare with water power for small cost. I expect to see the time—or at least I believe there will be a time, if I do not see it—when every waterfall will be utilized. This is becoming more and more possible with every addition to our knowledge of electricity. It is now not necessary as of old for a factory to actually overhang the stream from which the power is obtained; on the contrary, it is often better for it to be at a reasonable distance with only the generating machines at the canal or flume. Other things being equal, therefore, water power is best, for it is cheapest.

The only other commercial source of power is heat from coal or oil. The common form of reciprocating steam engine in its many forms of single and multiple expansion is at present almost universal, but it seems to me that a change from the reciprocating to the rotary is coming, our now popular type will become absolete, and the rotary type universally used.

This movement has made considerable headway in Europe and is beginning on this continent. The electric light company of my own city has put in the largest Parson's turbine (3,000 h. p.), which is running well and very economically as compared with the best reciprocating engines. Turbines of the De Laval type are creeping in very fast for small units of power, being better adapted to many small uses than any other machine. They are economical at all powers within their own maximum. The coming power, however, in my opinion, is that obtained from liquid fuel (oils) direct, perhaps from solid powdered fuel as well, or from either one gasified. We obtain power now in this way by so-called gas engines, more properly speaking combustion or explosive engines. As yet they are not always successful, but tremendous strides are being made in perfecting these engines and the number in actual use is now very large. All things considered, however, the best engine or other source of power for any given place or installation is not determined by its economy, its cost or the type, but rather by the combination of points that will contribute most to lessening the cost of production of a given article.

In the future we may look forward to the storing of power from the heat of the sun. This is now experimentally possible and is being accomplished in the sunny climate of California; but I do not think that any of you gentlemen would undertake to equip a new plant just at present and in this climate with its only source of power the sun. Many things more wonderful have been accomplished lately, but this scheme will wait until the commercial necessity for it arises, although it looks to me as if the present rise in the price of coal would hasten its coming.

Then, again, the man who professes to multiply power indefinitely by intricate systems of gearing or some other equally impossible scheme is not yet dead; I fear we must jolly him along, however, and let him down easy without counting him as a serious proposition. He is ingenious and interesting, but not profitable.

Having the power, how shall it be most economically distributed to the producing point? Means for doing this are multiplying fast through the development of electricity, gas engines and the use of compressed air. The various possible systems are in part as follows:

Steam engine driving shafting by gearing, spur or bevel.

Steam engine driving shafting by belts or ropes.

Steam engine driving electric generator transmitting power over a plant with but few, if any, belts or gear drives.

Steam engine driving compressor of air and transmitting power in pipes over a plant to many forms of tools and lifts.

Gas engines transmitting power by belt or otherwise.

Central gas generating plant distributing gas over a plant in pipes to many engines of small units.

Every engineer or factory manager has his own ideas about these methods, and I dare say every one is much in the right as to his own particular case, in regard to which he is necessarily well informed. No one of the methods is best for all cases. Each particular one must be studied carefully. Conditions are also changing rapidly, what may be best one decade may not be best the next. How rapid this change is is well illustrated by the following quotation from a most eminent engineer, made as recently as 1867, William Fairbairn. In discussing transmission, he said, in part referring to belt drive, at that time new and mostly used in America, while the gear drive was almost universal in Europe, "the advantages of straps (belts) are the smoothness and noiselessness of the motion; their disadvantages are cumbrousness, the expense of their renewal and necessity of frequent repairs. They are inapplicable where the motion must be in a constant ratio, because, as the straps wear slack, they tend to slip over the pulleys and thus lose time."

How little these things seem to bother us now, and how few gears there are as compared with belts, notwithstanding the faults of the belts, as expressed by Mr. Fairbairn. It is almost useles, it seems to me, to talk on such subjects as these, inasmuch as what one says becomes obsolete so soon. All one can do is to act quickly in establishing a plant; take that which is most applicable at the time, and charge off each year enough from the machine account to buy all new in ten years at the longest. Above all things, in laying out a plant, no matter how small, do not proceed by rule of thumb, but think the entire arrangement out and plan it to scale on paper, determining the speed and position of every shaft and pulley; providing for everything beforehand. By other methods much work is repeated, and never as well done as it it might be.

The most lively discussion has always followed when the question of electric transmission has come up for consideration in all our engineering societies. Its exclusive use is advocated by some. By others it is absolutely condemned. The intermediate course will be the final one adopted. For certain work it is incomparable. For example, the large printing presses of to-day may be better manipulated by separate motor than by belt drive from main shaft. Entire independence of speed, reverse, repeated trials of the print, stopping and starting, and finally the cleanliness, make the motor drive directly connected, almost essential. The government printing office at Washington has materially reduced the expense and increased the product by the adoption of the motor drive throughout the place.

All machines served by overhead cranes should be motor driven so that the crane shall not meet the interference of belts. The printing press is one of these. All shops where groups of machines are run independently of other groups should be equipped with motors for each group. As a rule it is well to equip all heavy machine tools with independent motors, inasmuch as such tools stand idle much of the time. The plants in cotton and woollen mills need not be equipped with motors, unless perhaps, certain floors and departments are often run alone or are frequently shut down when the remainder of the mill is in operation. Anything that will do away with heavy and long belts will prove a commercial advantage. One case that came to my knowledge was a long belt that drove machinery in another building and around a corner. Some thirty horse-power was consumed in driving the other department. A separate motor was installed for a trial. A ten horse-power motor did the work and consumed only about six horse-power doing it. The trial became a permanent fixture.

How far to carry the idea is hard to determine. The first cost may be heavy, and yet such savings result that this cost is wiped out in a year. Convenience in a shop, rather than the cost of the motor or the power to run it, is most often the determining factor. Assuming that by introducing electric motors generally throughout a shop, the cost of all things considered were the same, it is quite possible to imagine such conditions that increased convenience would save 50% of the cost of the product. First cost and power might be disregarded under these conditions. Every case should be carefully considered by one familiar with all the conditions. If in doubt, a few motors should be tried, but nothing under five horse-power units should be used except in rare cases. The smaller units are expensive and not efficient, and machines should be grouped to get the five

horse-power. Below two horse-power the electric motor is not efficient.

Competent and careful investigators have repeatedly found the losses of transmission due to driving or transmission devices to vary from 5 per cent. to 90 per cent. of the total power consumed. Here, then, in these days of small margins and close competition is the chance to save an annuity that will amount to a fair profit in most cases. The question of using copper or aluminum for transmisssion purposes is one worthy of consideration. In the case of a 9 mile transmission plant in my state, aluminum has been used. At the time of installation copper was selling at 17 cents per pound, and aluminum at 41 cents, yet the reduced weight of the latter made it the cheaper of the two. The average loss of transmission for the cotton mill and flax mill is 60 per cent., and for the woollen mill 40 per cent. In heavy iron working plants the loss is about 15 per cent. In any small mill or workshop the matter of friction is of the greatest importance, and, if I am not greatly mistaken, it is in the small mill that one generally finds the greatest neglect in such matters. In the large organizations such things are in the hands of some particular person, whereas in the small mill it is no one's business, and is neglected. Friction in mills is subject to great variations. Probably half the friction in the small mill is caused by lubricated surfaces. A change in temperature with improper lubricants, such as heavy animal oils, may increase or diminish friction to a considerable extent. Prof. Thurston estimates the friction of shafting in general, including the total belts and bearings, and varying with the size and load, at from 33 horse power to 1.5 horse-power per 100 feet. Prof. Benjamin, by careful investigation in many shops and with every precaution for practical and at the same time accurate results, found that in six machine shops, where heavy machine work was done, an average of 62.3 per cent. of the power produced was used in driving the shafting alone. In one case it was 80 per cent. This was explained by the fact that the shafting had to be built large enough for tools that are often idle, and necessarily the shafting must be kept running. In this item the tension of belts is a serious matter. A belt should be just tight enough to do its maximum work. Many belts, if not most of them, are much tighter than is necessary. No easy means is at hand to ascertain how tight a belt may be, and the belt mechanic sets it firm and tight to make sure that it shall not slip. Then when a wet day comes, a shop full of moderately tight belts makes a heavy drain on the coal pile. In this same investigation it was determined that the busiest of tools was only in operation 80 per cent. of the time, and the average tool about 33 per cent. of the time.

The argument has been made by those opposed constitutionally to nice work toward economy of any kind that the power amounts to little or nothing in the cost of a product. As a matter of fact the cost in percentage is small in machine shops, being from 1½% to 2%. This seems small indeed when stated this way ; but looked at as an annuity it takes on another aspect. Supposing for example the product costs a million per year, one per cent. means ten thousand dollars.

Another class of losses occurs in the bearings of the machines themselves. It has been found by test with motors, for the driving power, that printing presses, and other heavy machine tools, consume twice the power running idle that they should. Investigation disclosed the fact that the loss was in the bearings, and that they were very tightly adjusted. There is no means of telling how tight a bearing is when it is one of many in a train ; and had the machines in the cases mentioned been belt driven from a shaft, the friction would have continued until heating occurred or until the bearings wore loose. Again, to offset the argument that power saving is in any case only a small factor, we must consider that where there is friction there is wear, and that cost of repairs is increased by friction. This is a serious matter in the case of line shafting and counters. It means a mechanic at the works many Sundays in the year, to overhaul bearings and loose pulleys. The following general principles have been laid down by Prof. Benjamin to save friction losses in manufacturing establishments. There are none better and I quote :

1. Use pulleys of large diameter on counter shafts and narrow fast running belts.

2. Use the best oil for the purpose, and enough of it, catching the drip and purifying it for repeated use.

3. Have everything oiled regularly, and do not depend too much on even the best of oiling devices.

4. Inspect line shafts to see if in line and will turn easily.

Neglected shafting, both in respect to alignment and lubrication, is the cause of tremendous friction. Anything that will do away with both of these evils at once deserves earnest consideration. A good so-called "frictionless" bearing will do this, as lubrication is practically unnecessary, and heavy pressures produced by lack of alignment count but little. More of this later. Samuel Webber sub-divides the friction in a mill as follows : To run loose pulleys and their belts, 10 per cent. ; to run main shafting, 20 per cent.;—the engine itself takes but 6 per cent. He puts overtight belting and consequent bending of shafting with resulting heavy journal friction as the chief cause of transmission losses. I think the average manager does not look at it in this light. Even this source of friction may be avoided. If managers of factories would only take the pains to measure their idle load once in a while, they would find the information gained both instructive and surprising. Comparatively few do it.

Some noon hour, or some evening at six o'clock, turn off all work on all machines and see what your engine indicates ; it is something any of your engineers can do if furnished with an indicator, and I am sure you will feel repaid. Nine times out of ten you will overhaul a considerable number of things.

Is it not true that in almost any shop, if the bearing does not get heated, if it does not make a noise, if it does not stop the mill and nobody kicks, that there is not much thought about it ?

My experience in such matters has been that some shafts may be turned by hand, and in other cases of similar dimensions a bar stuck through a pulley may be used for a lever in order to move at all. Subsequent test in these cases showed corresponding losses. In one or two instances I have seen loose pulleys driving shafting and waiting for Sunday repairs.

As a matter of general interest I thought I would look up the origin of belts. After doing so I made up my mind that it was prehistoric. The first belt on record seems to be in connection with the fire machine, the original method of starting a fire by friction. A ligament or other string was wound about a pointed stick and pulled as in spinning a top. Then followed the use of the belt in all the various ways known to us. It is old, but it is good, and I doubt very much if we shall ever drop it entirely, notwithstanding electrical motors. The rope is newer as a commercial feature. It serves its purpose admirably and is an efficient driver. Careful experiment has shown that when well arranged in each case, the efficiency of belt and rope is practically the same. The rope has one practical advantage and that is, that the tension may be exactly controlled by tension pulley and weight. On the other hand, the rope is not good for small powers. The necessary splicing and complication of manipulation count against it and practically bar the use of any size smaller than ¾ of an inch. A rope running over too small a pulley goes to pieces very fast, and the rope drive has suffered on account of this mistake in installing.

The following figures give an idea of the proper relative size of rope and pully :

For a 1¼ inch rope, diameter of pulley must be at least 3 feet.
For a 1½ inch rope, diameter of pulley must be at least 4 feet.
For a 1¾ inch rope, diameter of pulley must be at least 5 feet.
For a 2 inch rope diameter of pulley must be at least 6 feet.

These pulleys and ropes will transmit respectively per 100 revolutions per minute, 5, 8, 11, 15 horse power.

An increase of 25 per cent. over these figures is possible when the bottom rope is the driver and under proper conditions. The best speed is about 3,300 feet per minute. Cotton and manilla are equally good providing long fibre cotton is obtained, and, in any case, the character of the splice is all important.

The comparative efficiency of belt and rope, as determined at Lisle, France, by official investigation, is as foliows : Power transmitted, 162 horse-power ; taking efficiency of rope at 100 (manilla) cotton is 100.87 and leather belt 100.37. To all practical purposes this difference is nothing.

As I have already emphasized, belt tension is most important. Ii is estimated that the pull of a belt is, as a rule, at least three times that necessary to transmit the power required. The velocity of belts should be kept at the maximum possible point, and the most efficient velocity is given at 4,000 to 5,000 feet per minute. Data on belts is to be found anywhere, and I will say but little, as there are branches of my subject on which there has been absolutely nothing written or published.

Mr. Souther spoke at considerable length on the subject of bearings and lubricants, advocating the greater use of the ball bearing and mineral oils.

THE DEVELOPMENT OF ELECTRICAL SCIENCE.

Major Henry A. Gray, president-elect of the Engineers' Club of Toronto, delivered his inaugural address at a meeting of the society on February 4th. After reviewing tersely the progress that has been made in harnessing the great natural forces of the earth, and the extension of railways, he traced the development of telegraphy, telephony and electric lighting, and quoted figures of very great interest. This portion of his address is given in greater part below :

TELEGRAPHY.

In the year 1837 Cooke & Wheatstone showed how electricity could be practically used in the intercommunication of ideas between different parts of the country. There was a line built in July of that year, connecting two small towns in England. A portion of this line was recovered during the year of the Queen's Diamond Jubilee, and used in the transmission of her simple, and at the same time, expressive message, as she started on her memorial procession through London, "From my heart I thank my beloved people. May God bless them." This was sent to every quarter of the Globe, being flashed over every continent, under every ocean and sea, and among the many replies from British colonies and elsewhere, the first to be received at the palace was from Ottawa, Canada, just 16 minutes after the message had been despatched. The line to which I have just referred was 1½ miles in length ; during the 65 years since this pioneer line was inaugurated, the system of telegraphy has grown to embrace, I may say, the



THE LATE C. W. LUNDY, Telegrapher, Halifax, N.S., who received the first message by Atlantic cable. Deceased December, 1901.

entire world, thus almost annihilating distance, and practically overcoming time.

The extent of telegraph lines controlled by Britain and her colonies in the year 1895 was 1,111,366 miles; of this, 183,400 miles was submarine cable. England has always been in advance of other countries in the development of telegraphic service, which is chiefly due to inventions of members of our profession, viz., Latimer Clarke, his brother Edwin Clarke, and Cromwell Varley, all members of the Institution of Civil Engineers. The working capacity has been greatly increased, and messages can now be sent with a rapidity so great that they cannot be received by the clerical staff. The submarine cable still retains very nearly its original form, and the nature of the materials used in its construction have varied but little since the first cable was laid in 1851. The little crustacean which was found to be able to penetrate the gutta percha covering and thus expose the copper conductor to sea-water, which meant certain destruction, has been prevented by the use of a serving of brass tape, this having proved very effective. To the great inventive genius of Lord Kelvin, the perfection of the submarine cable is chiefly due. His recording apparatus is the one almost universally used to-day in cables of great length.

To attempt to predict, at this moment, what the future of telegraphy will be would indeed be folly. New instruments and new processes are constantly being introduced, some of which are adopted, others are found to in no way improve the present practice, or meet existing needs. The writing telegraph, invented by the late E. A. Cowper, which produces actual handwriting, and is called the "Telantograph," is being made practical use of, and electrical typewriting machines are by degrees replacing the A. B. C. visual indicator.

It is by no means, in my opinion, visionary to say that in a very short time wires in telegraphy will be entirely dispensed with, and messages of length and importance flashed through the air by means of Marconi's wireless telegraphy.

TELEPHONY.

The introduction of the telephone has to a great extent revolutionized the business methods of the day. The development of telephony has been so rapid as to seem almost incredible, and yet we know that the human voice is transmitted along wires for great distances by electricity every hour in the day.

It was in the year 1877 that two eminent engineers were sent from England to the United States to inquire into the accuracy of the report that a young Scotchman, by the name of Bell, had succeeded in accomplishing the astounding feat of making it possible for conversation to be carried between two or more persons separated by many miles, and it was in that year that the first pair of practical instruments were brought into England from the States by Sir Henry Fischer and his colleague, Mr. Freece.

The transmitting portion—that part which transforms the energy of the human voice into electric currents—has constantly been improved since Edison and Hughes demonstrated the use of carbon in a loose condition, subject to the change of pressure and of motion under the influence of sonorous vibrations. Speech is now possible between any two cities in the Dominion of Canada, and many of the principal cities in the United States. Telephony has become a part and parcel of the business institutions of the country, similar to the post and telegraph.

Concerning the Bell Telephone Company, in the year 1880 it had 13 exchanges, and a total of 2,100 subscribers. In 1900 it had 350 exchanges, 494 agencies and about 39,000 subscribers. It also had in 1900 some 22,000 miles of long distance lines.

The figures in the United States are approximately 47,880 subscribers in 1880, and 800,000 subscribers in 1900, with over 600,000 miles of long distance lines.

In 1899 the German Empire had 229,391 stations ; Great Britain, 171,660 ; Sweden, 73,500 ; France, 59,927 ; Switzerland, 38,864 ; Austria, 32,255 ; Russia, 31,376, and Norway, 29,446.

ELECTRIC LIGHTING.

Just about 58 years ago Morse and Vail first gave a public exhibition of the electric telegraph, the earliest and for many years the only important application of electricity to the useful arts. It is difficult to realize that only a few years has elapsed since the first illumination of the streets of Paris by the electric candle, during the Exposition of 1878, gave renewed impulse to the study of electricity, which has resulted in the development of a long series of inventions already destined to make this subtle form of energy one of the controlling factors of modern civilization. In a work recently published on the economic value of electric light and power, the following interesting statement occurs, the truth of which will, I am sure, be recognized by every one here. So much has been done in applying electricity to the uses of light and power, that the following statement of some of the possibilities is no longer prophetic.

Electric light and power will produce more changes in the mechanical servants and conveniences of civilized life than has ever been caused by the use of any other method or force which has been subjected to the service of man. The uses of electricity are limited only by the want of intelligence in producing fitting apparatus for its application. The demand for such apparatus is limited only by the want of intelligence on the part of the public to know how to use it properly. So rapid has been the development of the electric industry, few have been able to keep trace of its achievements, and fewer still have sounded its possibilities for the purpose of giving direction to its growth.

It is now practicable to distribute from one central station all the light and mechanical power used in any city. Not only this, the light and power can be delivered to any point in the city, and more important still, it can be divided and delivered in any quantity needed. From the same central station, the same generator in the station, if need be, accompanying each other over the same conductor, as it were one spirit with two forms of expression, the electric current places at the command of the poorest member of society two basic requirements of civilized

life, viz., light and power. They come without noise, heat, smoke dust or dirt of any kind. They consume no oxygen from the air; they bring no poisonous gases into the rooms; they destroy no property; they make life more healthful, comfortable, and freer from liability to accident; they are brought into use without any effort whatever; with silent, patient energy they wait the will of their employer.

But turn a key, and light appears where the sun cannot shine. But turn a key, and the tireless energy of the universe will play alike with the smallest toy, or the heaviest machine. Comply with its conditions, and the servant of all life will be present in light and power.

In June, 1877, William Edward Sawyer, a native of New Hampshire, who had been for some years a telegraph operator in the New England States, directed his attention to the making of inventions in electric engineering and electric lighting. The first direct satisfactory results of his labors in this direction was the improvement in electrical engineering and lighting apparatus and systems for supplying streets, blocks or buildings of a town or city, in a practiceable manner, with any desired quantity of electricity for the purposes of electrical illumination, electric heating, and running electro magnetic engines, etc. Generators of electricity were to be placed in convenient localities, and conductors carried over or under the ground along the streets, and to buildings in which the electrical current is to be utilized. The advantages of his invention are that it enables householders to obtain a supply of electricity for any purpose without care or inconvenience, and at a reasonable cost to consumers, and also renders practicable the lighting of buildings by electricity.

In the same year Sawyer patented a lamp, which although crude and impracticable to some extent, showed the line of investigation and development which he was pursuing. Unfortunately, Mr. Sawyer was, as is frequently the case with inventors, a man of limited means, which seriously retarded his work of perfecting his incandescent lamp, and it was not until he fell in with a lawyer by the name of Man, who was a scientist and had always taken a deep interest in the study of electricity, and being a wealthy man, he at once placed a sum of money at the disposal of Mr. Sawyer, which enabled him to continue the inventions, uninterrupted, until he had fully developed his original conception of a general system for the electrical distribution of light and power from a central station.

It was at this time, according to the earliest records, that the name of Thomas A. Edison was used in connection with electric lighting. In September, 1878, Mr. Edison went to work with a vengeance on the scheme of electric lighting, and in a very short time made the startling announcement that he could produce any number of lights up to 10,000 from the one machine, or for that matter the number he said may be infinite. But the actual results attained by Edison at the close of the year 1878 must be conceded to have accomplished nothing more than the old idea of an incandescent wire of platinum, a useless thermal regulator designed to be attached to each individual lamp, and the absurd tuning fork dynamo. He was on the wrong track, and had been from the very beginning. The triumphs of the future, as we now know, were destined to be accomplished by incandescent carbon, not by incandescent platinum, and by regulating the current at the source of the supply, and not at the individual burners. In both these points Sawyer was far in advance of Edison, for he had clearly shown by the patents that had been issued to him, and the intelligent conception of the nature of the problem upon which he was at work, an equally clear view of the true path to be followed in the development of the incandescent electric lamp. This was fully proven by the controversy which took place at the close of 1878 between Sawyer and Edison.

The further development of the hydro-carbon treatment was taken up at an early date by Hiram S. Maxim, under the auspices of the United States Electric Lighting Company, the first commercial incandescent lighting plant being installed in 1880 in the reading rooms of the Safe Deposit Company, 120 Broadway, New York City. This plant consisted of about 50 lamps, the illuminants of which had been subjected to the hydro-carbon treatment. In this lamp it was generally conceded that something like perfection had been reached, and Professors Morton and Draper testified to the value of the invention of Mr. Maxim, stating in their evidence that even Edison's dreams had been surpassed in the Maxim lamp. It is this style of lamp that is in use to-day.

The growth of electrical enterprises in United States and Canada is without doubt unparalleled in the history of the world in industrial development. Looking at it from a commercial point of view, incandescent lighting dates no further back than 1880.

I have obtained a few statistics showing the number of companies doing business in electricity in Canada in connection with lighting, which has increased from 259 in 1898, to 306 in 1901. The arc lights in use have increased from 10,389 to 12,800, and the incandescent lamps from 464,615 to 815,676. Estimating each arc lamp equal to ten incandescent, the use of electricity as a light has developed from 565,505 in 1898 to 943,656 in 1901. During these years, electricity for lighting purposes has increased over 60 per cent., or by some 276,171 lamps.

Of the number of lamps in use Ontario has 6,830 arcs and 384,496 incandescents, or about 48 per cent. of the total for the Dominion. In the city of Toronto there are 1,450 arc lamps and 80,000 incandescents, which equals a total of 94,500 incandescents. Ottawa has 585 arcs and 80,000 incandescents, or a total of 85,850, counting each arc as equal to 10 incandescents. Hamilton has 560 arcs and 21,265 incandescents, or a total of 26,895. London has 350 arcs and 17,180 incandescents, or a total of 20,680. Peterboro has 120 arcs and 7,000 incandescents, or a total of 8,200.

Quebec Province has not progressed so rapidly in the electrical line, and the number of arc lamps is 41,118 and the incandescents 270,120, or reduced to the standard of 1 arc equalling 10 incandescents, a total of 311,300. Montreal has out of this number 2,648 arcs and 108,210 incandescents, or a total equal to 134,690 incandescents. Altogether in the Province of Quebec there are 42 cities, towns and villages having electric plant companies, 22 of them are in the eastern townships.

Nova Scotia's total equipment is 465 arcs and 49,041 incandescents, distributed among 20 towns and controlled by 21 companies.

New Brunswick's total is 691 arcs and 18,131 incandescents, distributed among 10 cities and towns and owned by 11 companies.

Manitoba has only six towns provided with electric lights.

The North-West Territories have 5 electric light equipments.

British Columbia has 14 plants, furnishing 643 arc and 68,763 incandescent lamps; Vancouver city has of these 411 arcs and 29,424 incandescents.

The foregoing make a grand total for the places mentioned of 12,892 arcs and 825,201 incandescents, and reducing all to the standard of 1 arc as being equal to 10 incandescents, makes 954,121 lights in the year 1901. Contrast this with the year 1877, when Messrs. Sawyer & Man were endeavoring to perfect their first incandescent lamp, and we can then, to some extent, realize the development that has been made.

Of the total increase of 276,191 in 1901 compared with 1898 Ontario is credited with 152,755, Quebec 154,009, Nova Scotia 10,049, New Brunswick 7,431, Prince Edward Island 4,765. Manitoba is credited with 4,058, Northwest Territories 1,255, British Columbia 41,757.

MONTREAL.

(Correspondence of the CANADIAN ELECTRICAL NEWS.)

The Royal Electric Company deserve the highest praise for the way they hustled around after their rather serious fire lately. They had all arc circuits and private alternating circuits running the same evening. It is open to doubt if any other company in the Dominion could have done as well under similar circumstances. Every man pitched in with a will the moment the firemen had left the building, working in the smoke of coke fire pots (as used by plasterers for drying), which were immediately started to dry out the building. Luckily, the step-down transformers of Chambly transmission, which were in a wing, did not get damaged; and the small extra station at Sohmer Park was brought into play to take care of the street arcs. Even to-day the building is coated with ice where besprinkled by the fire department, and the old window frames temporarily sheeted with cotton show that the fight with fire was a good one. The new step-down and distributing station now under construction will be absolutely fire-proof and is being rapidly completed.

On the evening of the 20th January Prof. Rutherford gave an open lecture at McGill on the Marconi system of wireless telegraphy. It was a treat to all those that were able to get in, and "standing room only" was the order long before the lecture commenced. Prof. Rutherford advanced a theory of his own for the Hertzian wave following the rotundity of the earth's surface which is perhaps the most acceptable and certainly the most lucid yet promulgated, viz:—As the electric spark passes more quickly in vacuo than in the ordinary atmosphere, and as the higher strata of air is owing to its rarity a nearer approach to vacuum than the lower, Prof. Rutherford deduces that the wave leaving as it does at right angles, by travelling quicker above, retains that position until the receiving conductor is reached.

The third of a series of lectures before the Grand Trunk Railway Literary and Scientific Institute was delivered by Mr. W. B. Shaw, of the Montreal Electric Company, on January 21st. The subject was "General Information on Electrical Subjects of Use to Engineers and Machinists."



MARCONI VANQUISHES THE TRANSOCEANIC CABLES.
From the New York World.

AN IMPORTANT LEGAL DECISION.

THE CORPORATION OF THE TOWN OF RAT PORTAGE VS. THE CITIZENS TELEPHONE AND ELECTRIC COMPANY OF RAT PORTAGE.—Trial at Rat Portage on the 21st December. 1901, before Britton, J., without a jury.—On January 16th, 1902, Judge Britton delivered the following judgment :—This action is brought by the plaintiffs to have a contract on agreement, dated the eleventh of September, 1899, declared invalid on the grounds (1) that no by-laws was past authorizing or sanctioning it, (2) that the agreement was not executed by any duly authorized agent of the plaintiffs, and (3) that the agreement was not drawn, signed or sealed in a way to bind the plaintiffs.

Prior to 1895 the plaintiffs had made a contract with a company for lighting the streets of the town of Rat Portage. Defendants acquired the right of that company and with the consent of the plaintiffs, performed that contract until its expiry, and afterwards continued to furnish street lighting for the town. On the first day of February, 1895, a new agreement was entered into (Ex. II) by which the defendant company was to install electric plant, and do the street lighting of Rat Portage for five years from the first of February, 1895 on the terms stated in that agreement, which agreement was made with all the forms necessary to be binding upon the plaintiffs, and the terms of it are not very different from the agreement now in question. This agreement was for five years and was therefore good until the 1st of February, 1900. Having regard to the near approach of the time for expiry of this agreement, negotiations were on foot between the parties for a renewal—or for a new contract. On the 14th August, 1899, a resolution was passed by plaintiffs' council declaring all negotiations with defendants off, and instructing the clerk to call for tenders for a five years service for street lighting and fire alarm (Ex. 4). Tenders were advertised for, to be put in on or before the 7th September, 1899. Defendants' company tendered and in accordance with advertisement handed in with the tender a marked cheque for $1000. This tender was in the terms of a draft contract alleged by the defendants to have been agreed upon before them by a committee of plaintiffs' council.

The council met on the 11th September, 1899. The whole matter of street lighting, fire alarm and telephone service was discussed. Mr. McCrossan, the defendants' manager, was present; the tender and draft contract were produced, the defendants' manager was asked in consideration of a new contract being entered into, to relinquish any claims or charges for fire alarm maintenance accruing since November, 1898, and this the defendants' manager agreed to then and there, writing a letter to the Mayor and council to that effect (Ex. 7), whereupon the following resolution was adopted :

"That the tender of the Citizens' Telephone and Electric Company for street lighting, fire alarm, and telephone service, now under consideration, be accepted by this council, and the Mayor and clerk be authorized to sign the contract prepared, and the date of commencing under said contract be on or before the 30th day of September, 1899. This will enable the citizens to receive the benefit of the arc lighting in every advantage, as set forth in the said contract."

The mayor was not present at that meeting. The contract, which had before then been prepared, was at that meeting signed by C. W. Beylea, the acting mayor, and by the clerk, and the corporate seal of the plaintiffs' corporation was affixed.

On the following day, the 12th of September, 1899, the defendants got a return for the marked cheque for $1,000, which had been deposited with the tender. Shortly after the meeting of the 11th of September, it was rumored that the contract was invalid, because the mayor had not signed it. On the 13th of November, 1899, at a meeting of the council, a resolution was adopted, (Ex. 9) reciting the agreement of the 11th of September, the signing of it by the acting mayor, that the agreement had been questioned, &c., and then as follows: "Be it therefore resolved that this council doth hereby ratify and confirm the action of the said C. W. Belyea in signing the said agreement on behalf of the corporation of the town of Rat Portage, and also the said agreement, and it is further resolved that all other acts heretofore or hereafter to be done by the said C. W. Belyea in his capacity as acting mayor, and within the scope of his authority as acting mayor, are hereby allowed and confirmed."

On the 27th of November, 1899, at the meeting of the plaintiffs' council, the minutes of the meeting of 13th of November were read and confirmed, and signed, and the corporate seal was affixed at the foot of these minutes.

From that time until the commencement of this action the contract has been treated as a valid and binding contract, and has been satisfactorily performed by the defendants and paid for by the plaintiffs.

The whole story of the negotiations which led up to the making of the contract, is told in the statement of defence, and is in substance as now stated.

There are few, if any, facts in controversy between the parties. And upon the evidence, I find the facts as stated by me.

The plaintiff's contention is that no by-law was ever passed sanctioning the transaction, and by reason thereof the agreement is nugatory and invalid.

The contract was fairly entered into after a good deal of careful consideration, and the plaintiffs seem to have made a good bargain, safely one would think guarding the interests of the citizens. If there is any necessity for a by-law in this case the plaintiffs' council should have passed one, and if the plaintiffs can take advantage of their own neglect and repudiate their own agreement after two years' performance, it will be unfortunate.

The contract in question, even without express enactment, would seem to be within the powers of the council, for the business and safety and comfort of the citizens of a town of the size and importance of Rat Portage require street lighting, which the council should provide, but sec. 568 of the Municipal Act covers this point by enacting that

"Every municipal council shall have power to contract for a supply of gas or electric light for street lighting and other public uses, for any number of years not in the first instance exceeding 10, and for renewing such contract from time to time for such period not exceeding ten years, as the council may desire."

The whole question of the necessity of a by-law to create a liability on the part of a municipal corporation on an executory contract was discussed and decided in the case of the Waterous Engine Works Company vs. Palmerston 21 S.C.R. 556.

The sections 282 and 480 of the Municipal Act then in force were considered. Section 282 is the same as section 325 of present act, and section 480 for purpose of comparison and argument the same as section 565 of present act. In that case, in the absence of a by-law authorizing the purchase of a fire engine, and the contract not having been completed by the acceptance of the engine, the town was held not to be liable.

Apart from the neat question of the necessity of a formal by-law, what was done in this case is important on the questions of "executed contract" and estopped and acquiescence.

Section 568 authorizes the council to contract, and the council, in open meeting, acting as a contracting party, considered and decided upon the matter and authorized the signing of a formal contract by the acting head of the council and by the clerk, and authorized the affixing of the corporate seal. This is something done by the Legislative authority and was as well considered as a by-law. In substance it complies with all that is requisite. The form of by-law only is wanting.

There was no need of the resolution of the 13th of November, 1899, because the acting mayor has all the powers of the mayor, see Section 272. Section 10 provides that the powers of the body corporate shall be exercised by the council. Bernardin v. Dufferin 19 S. C. R. 581 is authority for the proposition that a corporation is liable on an executed contract for the performance of work within its powers, which work it has adopted, and of which it has received the benefit, though the contract was not executed under corporate seal. Upon the facts above stated the absence of a formal by-law is no more than the absence of a seal.

I think this is to all intents and purposes an executed contract —not completely because it has years to run, but the defendant had given up something of value and the plaintiffs have received the benefit of it.

A valid contract in full force on 11th September, 1899, was terminated by defendant ; claims which the defendant had against plaintiffs, including one of $50 a month from 1st December, 1898, to 11th September, 1899, were abandoned.

If cancelled now, plaintiffs get all the benefits bargained for after two years' service, which the defendant company agreed to give only by getting a five years' contract, renewable for another five years. Then the defendant company has by reason of plaintiff's agreement changed its plans, purchased a large amount of plant and expended money on improvements adequate compensation for which cannot be made by the payment which the plaintiffs are willing to make.

I am also of opinion that the plaintiffs are bound by their acquiescence and they are estopped from successfully maintaining an action.

The Corporation of Pembroke v. Canada Central Railway 3 O. R. 503 decides that a Corporation may be bound by acquiescence as an individual may. This is not a case of any rate-payer objecting. It is an action by the corporation which made the agreement. The council is not, so far as appears, asked by any citizen to take this action. The council—the acting body of the corporation—the council which made the contract, could if they thought proper have passed a by-law authorizing or ratifying the contract. Their not doing so looks like bad faith on the part of plaintiffs.

After the action of the council on the 11th September, 1899, the plaintiffs approve and acquiesce in the contract as before stated by me—1st, on the 12th September, by giving up marked cheque, 2nd, on the 13th November by formal resolution approving of the agreement, and 3rd, on the 27th November when minutes of 13th November were read, confirmed and formally signed and sealed with plaintiffs' corporate seal. Again this contract was acquiesced in by allowing defendant to continue in its performance, and by plaintiffs' estimates for the years 1900 and 1901 and by by-law in each year for raising by taxation, in addition to other sums required, the special amount necessary to pay to the defendants under the agreement in question.

The plaintiffs' council could raise the money to pay upon this contract only by by-law authorizing the rate and the collection of it. On these estimates see sections 404, 405, of Municipal Act.

The by-law authorizing the levy each year, in effect, and in a way the council could lawfully act, ratified the agreement in question. See Robins vs. Brockton, 7 O. R. 48.

The action should be dismissed with costs. The defendants are entitled to a declaration that as between the parties the contract is a valid and binding one, and the plaintiffs should carry out the same in all respects.

NEW WIRE AND CABLE FACTORY.

The accompanying illustrations show the works of the Dominion Wire & Cable Company now in course of erection in the city of Montreal. The company expect to occupy their new building in April. The ground floor of the factory covers an area of 30,000 square feet, and the first and second floors have each an area of 6,400 square feet. There will be an additional building erected in the spring, which will contain the offices of the company and extra store rooms. This building will be situated on Guy street.



FACTORY OF THE WIRE & CABLE COMPANY, LUSIGNAN STREET, MONTREAL.

When the new works are completed they will embrace departments for the manufacture of lead covered cables for telephone and power purposes, wire drawing and annealing departments, a rubber insulating department and a trolley wire plant. It is also the intention of the company to manufacture weather-proof wire and cables. The upper floors will be used entirely for the covering of fine wires and the manufacture of electro magnets.

The power plant is to consist of two B. & W. 300 horse power boilers and a Robb-Armstrong tandem compound engine, direct connected to a Western Electric Company generator. There will also be a Westinghouse generator set of 300 horse power. The electric elevator to be installed is being manufactured by the Otis Elevator Company, of New York.

NIAGARA POWER DEVELOPMENT.

Considerable progress has been made of late towards the development of power on the Canadian side of Niagara Falls. A fortnight ago the Canadian Niagara Power Company awarded the contract for the construction of the wheel-pit and intake canal of the Canadian works to Messrs. Dawson & Reilly, of St. Catharines. This contract amounts to over half a million dollars, bringing the total sum represented by contracts now awarded to one and three-quarter million dollars. The wheel-pit will be 175 feet long, running parallel to the river, with a width of 29 feet and a depth of 160 feet. The intake canal will be 600 feet wide where it comes in the river and 14 feet deep. The water from the river will be taken direct to the penstocks in the wheel-pit.

It is understood that contracts have just been placed with the General Electric Company for the construction of three 10,000 horse power generators for the new plant. These dynamos, it is asserted, will be the largest yet built. Vertical shafts over 100 feet long will connect the water wheels with the generators.

Mr. W. B. Rankine, vice-president of the Canadian Niagara Power Company, states that the company has received a number of inquiries for power on the Canadian Niagara frontier. The company is believed to be preparing to transmit power to Toronto and cities en route.

The Premier has introduced a bill in the Ontario Legislature to confirm an agreement between the commissioners of the Queen Victoria and Niagara Falls Park and the Canadian Niagara Power Company. The agreement, dated June 19, 1901, provides that the period for the completion of the work specified in the agreement of April 7, 1892, be extended to July 1, 1904, on condition that the company expend $500,000 on the work of development by July 1, 1902, and a further sum of $1,000,000 by July 1, 1903. The company shall also make default unless they develop 50,000 horse power by July 1, 1904, and have on that date an overflow tunnel sufficient for not less than 100,000 horse power and actually ready for use 20,000 horse power.

Mr. H. B. Andrews has resigned the management of Grimsby Park and will shortly leave Toronto to become superintendent of an electric railway in Tennessee.

The corporation of Glace Bay, N. S., have completed the installation of a municipal electric light plant. The power house is 72x40 feet, with a smoke stack 43 inches in diameter and 100 feet from the ground. The building is divided into two compartments, one being occupied by the boilers and the other by the dynamos. Of the latter there are two 72 k. w. 2,400 volts S. K. C. machines. The engines are of the Robb-Armstrong side-crank pattern, each 120 horse power. In the boiler room are two Mumford Standard boilers of 150 horse power each, placed on concrete foundation and set in brick. The plant furnishes current for 212 street lamps of 30 candle power and about 300 incandescent lamps in business places and residences. The electrical equipment was installed by Mr. W. H. Pickles, of the Canadian General Electric Company, and the power plant by Mr. C. D. McKay, of the Robb Engineering Company.



FACTORY OF THE WIRE & CABLE COMPANY, GUY STREET, MONTREAL.

INSPECTION AND OPERATION OF STEAM BOILERS.

TORONTO, January 30th, 1902.

Editor CANADIAN ELECTRICAL NEWS:

Dear Sir,—I noticed that at the last convention of the Canadian Association of Stationary Engineers the Legislative Committee was instructed to again try to secure the passing of an act to provide for the compulsory inspection of steam boilers and the examination and licensing of engineers in charge of steam plants in the province of Ontario. I consider this would be a move in the right direction, providing that the proposed law would be a workable and just one, and that it be enforced properly, and men appointed as inspectors who are practical engineers, and not selected on account of their political pull and heeling.

If we are to have a law here in Ontario, I trust it may not be such a farce as the law at present in force in the province of Quebec, as we would be far better off without it. I know for a fact that under this iniquitous farce men have received certificates as engineers who have never had charge of an engine in their lives, and I have it on good authority that one man went down from Ontario and was examined and received a certificate as a boiler inspector, and this same man had never had charge of a boiler and engine, or even held a position as fireman or served any time as a machinist in his life. But simply because his friends had a little pull he was awarded a certificate as a boiler inspector.

How would practical engineers (who have served many years in charge of steam plants) like to see a law in force in this province which would give authohity to men of no experience, like the above, to come round and inspect their boilers and pronounce an opinion as to whether or not they were keeping the boiler and machinery under their care in a proper condition and also for this same stamp of an inspector to have the power by law, of examining engineers for certificates of competency.

Unless the engineers of Ontario have some reasonable assurance that, in the event of their securing legislation, the positions of inspectors will be filled by practical and qualified engineers of good character, then I claim we had far better leave the legislation alone and go on as we have done for years passed, rather than be cursed with such an infamous law, which grinds out engineers without any experience as such, and boiler inspectors also occasionly, when sufficient pull is brought to bear in the right direction.

I may have more to say on this subject, Mr. Editor, in the future, as I am gathering information, and may be able to interest your readers more than at present.

Yours truly,

"PRACTICE."

MOONLIGHT SCHEDULE FOR MARCH.

Day of Month.	Light.	Extinguish.	No. of Hours.
	H.M.	H.M.	H.M.
1....	P.M. 6.20	P.M. 2.30	8.10
2....	" 6.20	" 3.20	9.00
3....	" 6.20	" 4.00	9.40
4....	" 6.20	" 4.45	10.25
5....	" 6.20	" 5.30	11.10
6....	" 6.20	" 5.30	11.10
7....	" 6.20	" 5.30	11.10
8....	" 6.20	" 5.30	11.10
9....	" 6.20	" 5.30	11.10
10....	" 6.30	" 5.30	11.00
11....	" 6.30	" 5.30	11.00
12....	" 6.30	" 5.30	11.00
13....	" 6.30	" 5.30	11.00
14....	" 6.30	" 5.30	11.00
15....	" 11.00	" 5.30	6.30
17....	" 0.00	" 5.30	5.30
18....	" 1.00	" 5.30	4.30
19....	" 1.40	" 5.30	3.50
20....	" 2.15	" 5.30	3.15
21....	" 3.00	" 5.30	2.30
22....	" 3.30	" 5.30	2.00
23....	No Light.	No Light.	....
24....	"	"	....
25....	A.M. 6.40	A.M. 9.30	2.50
26....	" 6.40	" 10.30	3.50
27....	" 6.50	" 11.30	4.40
28....	" 6.50	" 0.20	5.30
29....	" 6.50	" 1.15	6.25
30....	" 6.50	" 2.00	7.10
31....	" 6.50	" 2.45	7.55
		Total	214.30

THE GEE ELECTRICAL ENGINEERING COMPANY.

The Gee Electrical Engineering Company, Limited, 11 Colborne street, Toronto, is a comparatively new concern which has made rapid advancement. Business was commenced twelve months ago in the name of Gee & Company, with offices in the Queen City Chambers, Church street. The volume of business steadily increased until it became necessary to augment the capital of the company. A charter was obtained for a capital stock of $10,000, and a change in the name to the Gee Electrical Engineering Company, Limited, the directors being G. A. Harper, president; W. Gee, managing director; and W. P. Hunter. New premises were obtained at 11 Colborne street, and manufacturing was started. Very shortly it was found necessary to have still more capital, and application was made and granted for an increase from $10,000 to $50,000.

The Gee Electrical Engineering Company are manufacturers of dynamos, motors and electrical appliances generally. They make a specialty of outside wiring for lighting, telephones, bells, etc., and manufacture direct current generators, motors, arc lamps, rheostats, switches and electrical accessories. An important branch of their business is the manufacture of the Gould storage battery. This battery, it is claimed, possesses many points of merit over other batteries on the market, and it is



MR. W. GEE.

proposed to publish in the next issue of this journal some of the details of its construction, in which its advantages will be pointed out. The Gee Company believe that storage batteries will be very largely used in Canada for isolated plants, station work, etc. The company have secured a contract from the Gould Storage Battery Company, of New York, to build their train lighting equipments for this country. Thus, with the manufacture of the storage battery and the large business that is being done in dynamos, motors, supplies and wiring, there is every prospect of a promising future. The contracts now in hand include the wiring of Wm. Davies' new factory, Park, Blackwell & Company's factory, Harris abattoir, Grace Hospital, Leiderkranz building, York County Loan building, Ontario Wind Engine and Pump Company's building, complete lighting plant for George Rathbone, Toronto, apparatus for the Cannington Electric Company, complete overhauling of the plant at Port Colborne, Ont., and some twenty other contracts. The whole of the premises at No. 11 Colborne street is now occupied by the company, and arrangements are under way for further extension.

Mr. W. Gee, the managing director of the company, possesses a thorough knowledge of the electrical business. For seven years he was engaged with Woodhouse & Rawson, London, England, and for five years with the Edison-Swan Company, of the same city.

The many friends of Mr. H. P. Dwight, President of the Great Nortl.-Western Telegraph Company, learned with regret a fortnight ago that he had accidentally broken his leg, and will in consequence be confined to his home for some weeks at least. It is learned, however, that he is making favorable progress, and conducting the correspondence and business of his office from his home. It is hoped that in a very short time he may be able to be about again as usual.

CANADIAN ASSOCIATION OF STATIONARY ENGINEERS.

The Educational Committee of Toronto No. 1, C.A.S.E., some time ago secured the promise of Mr. Warren S. Johnson, Am. Soc. M.E., president of the Johnson Electric Service Company, of Milwaukee, Wis., that he would come to Toronto and deliver a lecture before the Association. Accordingly, arrangements were made for the lecture to be given in Engineer's Hall, 61 Victoria street, on Wednesday evening, February 5th, the subject being "Heat Control." A large number of engineers and interested persons were present to hear Mr. Johnson, who is perhaps the best authority on the subject in question on the American continent. There was much disappointment when it was announced by the president that Mr. Johnson had become snow-bound and was unable to reach Toronto in time to fill his engagement. An effort will be made to fix another date with Mr. Johnson. At the request of the president an informal talk was given by Mr. King, of the Toronto Engineers' Club, who had recently returned from Philadelphia and New York, whither he went to secure information on the question of steam heating.

The annual At-Home of Toronto No. 1 will be held in St. George's Hall, Elm street, on February 24th.

SPARKS.

A Hamilton woman is seeking to have an electric light company restrained from destroying her peace with a noisy dynamo. She went to Hamilton for rest and quiet, and she is certainly entitled to it.—Toronto Star.

A dfspute between the Dominion Coal Company and the Cape Breton Electric Company is attracting attention at Sydney, N.S. The workmen of the latter company laid several hundred yards of rails at different points where the proposed tramway will cross the old Reserve road-bed. Next day the rails were removed from the Reserve crossing by the Dominion Coal Company. It is said that the tramway people claim that as there are no rails on the Old Reserve road-bed they are within their rights in laying their rails across the old track. This the coal company deny, claiming that the electric company has no power to do so without legislative authority.

The Halifax Tramway Company carried out extensive improvements to their plant during 1901, and it is their intention to expend a considerable sum this year on the lighting department. The new city street lighting contract with the company takes effect on July 1st next, and is for five years. Under the new contract the company will give the city the very latest type of lamps. About 250 arc lamps will be required for the city streets, and the incandescent lighting capacity of the station will be increased about 9,000 lamps. A new generator, direct connected to a 1,500 horse-power engine, is about to be installed. It is also probable that the company will add another battery of boilers of 500 horse power. Mr. F. A. Huntress, manager of the company, is busy preparing for the installation of the new equipment, and expects to have one of the most complete stations in Canada.



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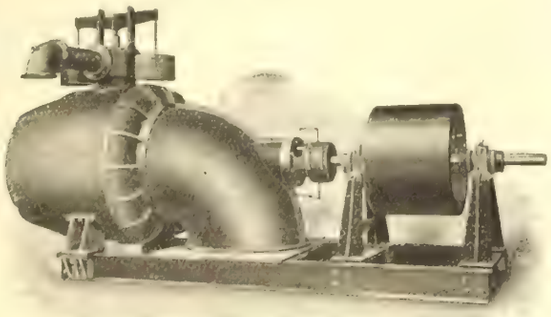
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SPARKS.

It is understood that the Dominion Government will place a sum in the estimates to assist Marconi in building his proposed wireless telegraphy station in Cape Breton.

The power house of the Niagara Falls Park & River Railway Company at Niagara Falls, Ont., suffered slightly by fire on January 17th. The fireproof nature of the building prevented much damage.

The Peterborough Radial Railway Company is asking for incorporation, to construct a railway through and connecting the villages of Peterborough, Ashburnham and Lakefield, and eventually extending to Rice Lake.

The annual meeting of the Montreal Telegraph Company was held in Montreal last month. It was decided that the board of directors should in future be composed of six members instead of eight, the places made vacant by the deaths of Mr. Andrew Allan and Mr. Hector MacKenzie not being filled. Mr. Hugh A. Allan was re-elected president, and the board of directors was continued as before.

Dr. J. C. McLennan recently delivered an interesting lecture in the Physics Building of Toronto University on "Some Recent Advances in Electricity." He demonstrated the fact that a leakage of electricity takes place through gases, from that going on to deduce that gases are divided into minute particles, and arguing that the negative-charged particle must be smaller than the hydrogen atom, until very recently regarded as the smallest in existence.

Messrs. Murray & Gregory, of St. John, N. B., applied to the city council for a lease of the islands above the falls. They intimated to the council that it was their intention to develop the power electrically. Ald. Millidge pointed out that there would be difficulty in doing this owing to the intermittent tides, by which the force of the power would greatly vary. Mr. Gregory admitted that was a difficulty, but thought it could possibly be overcome by the use of the new Edison storage battery. He had written to Edison explaining the conditions and sending him photographs, etc., and he had replied that he was much interested in the idea and that he had no doubt his battery would prove adequate for the requirements.

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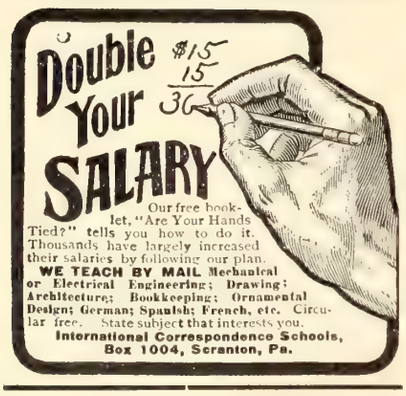
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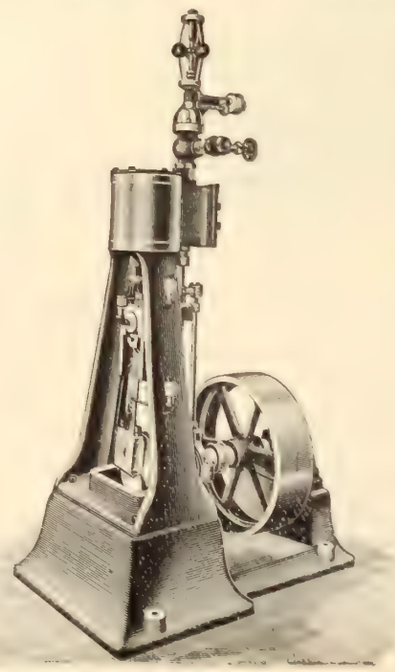


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SPARKS.

It is reported that Vooght Bros. intend installing an electric light plant in the new departmental store which they purpose building at North Sydney, N. S., this spring. The plan of the building are being prepared by Mr. David Brown, architect, of Montreal.

At a meeting of the directors of the Woodstock, Thames Valley and Ingersoll Electric Railway Company, held in Woodstock recently, Mr. J. H. Armstrong, secretary-treasurer, presented a report of the operations of the road for the six months ending December 31st. The net results show a dividend of 5 per cent. on the bonds and of 2½ per cent. on the preferred stock, while leaving a substantial balance in the treasury. This road was built by the Von Echa Company, who are now building an electric road between Brantford, Galt and Berlin.

The distributing station of the Royal Electric Company, Montreal, was recently damaged by fire to the extent of $30,000. The city lighting was not seriously interfered with.

The Wolfville Telephone Company, Wolfville, N. S., have elected R. E. Harrison as president, and Dr. DeWitt as secretary-treasurer. The capital stock of the company is $5,000.

The annual meeting of the Hamilton, Grimsby and Beamsville Electric Railway Company was held in Hamilton on January 25th. The statement showed that the gross earnings for the past year were $48,849.29. The operating expenses were $32,597.65, and after deducting interest, fixed charges and dividends, a balance remained of $1,930.24. These directors were elected : C. J. Myles, president ; R. S. Martin, secretary ; L. Bauer, R. S. Harris, A. H. Myles, Robert Ramsay and W. J. Harris.

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SPARKS.

The electricians of St. John, N. B., are discussing the formation of a society.

The Farmers' Electric Water & Telephone Company has been incorporated at Cardston, N. W. T.

The Sleeper Engine Company, of Montreal, is seeking incorporation. The capital stock is to be $250,000.

The capital stock of the Dominion Wire Manufacturing Company, Limited, Montreal, has been increased to $1,000,000.

A tramway, two and one-half miles long, from the Silver Hill mine to Nelson, B. C., was put in operation recently, its purpose being to carry ore.

A committee has been appointed by the council of Port Arthur, Ont., to investigate and report upon the feasibility of establishing a municipal telephone exchange.

Messrs. Alford & Lewis, who recently purchased the street railway at Belleville, Ont., have applied to the county council for a franchise for an electric road connecting Belleville, Shannonville and Trenton.

Mr. Fitzpatrick, C. E., acting for the Canadian Electric Light Company, has made a preliminary survey of the municipality of Levis, Que., with a view of preparing plans for a proposed electric railway along the principal streets of the town.

Incorporation is being asked from the Dominion Parliament for the Dawson City Electric Railway Company, to establish a power house in the Yukon Territory and to operate an electric railway within Dawson City and Klondyke City and without to a distance not exceeding three miles. Mr. H. C. McGiverin, of Ottawa, is acting for the company.

STORAGE BATTERIES

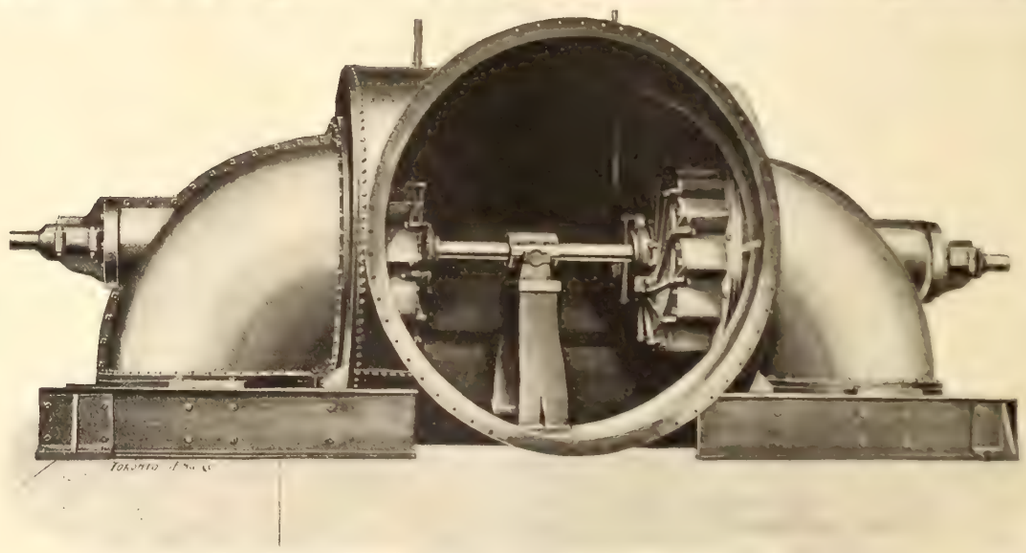
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PERSONAL.

Mr. Charles Moseley, chief engineer of the Toronto Incandescent Light Company, has been chosen president of the Toronto Technical School Board.

Mr. Charles S. Drummond, a director of the British Electric Traction Company, who control the leading electric traction systems of Vancouver and Nelson, B.C., recently visited Canada in connection with the company's interests here.

The many Canadian friends of Mr. D. Thomson, formerly manager of the Hamilton Light & Power Company, will be pleased to learn that he has recently been appointed president and manager of the Thomson Electrical Company, Manhattan Building, Chicago, which company is manufacturing several of his specialties, and is also engaged in electrical engineering. Mr. Thomson is a brother of Professor Elihu Thomson.

The Corporation of Trinity University, Toronto, have recently elected as one of its members Mr. Frederic Nicholls, general manager of the Canadian General Electric Company. Mr. Nicholls has accepted the position, and in doing so has expressed his hearty sympathy with the policy which Trinity is endeavoring to promote in the consolidation of the university interests of the province. The Provost in announcing Mr. Nicholl's election said that the university was to be congratulated that a gentleman of Mr. Nicholl's qualifications had been induced to throw his energy and executive ability into the cause of higher education.

Owing to additional duties falling upon the shoulders of Mr. Buntzen, manager of the British Columbia Electric Railway Company, as the result of the proposed development of the water power at Coquitlam Lake, it has become necessary to make several appointments to relieve him of some of his former duties. Mr. D. H. Shiles becomes traffic superintendent, with full control of this department on both the Vancouver and New Westminster branches, and headquarters in Vancouver. The position of local manager at New Westminster will, it is understood, be given to Mr. F. R. Glover, who is vacating the office of city clerk to fill the position.

At the annual meeting of the Toronto Electric Light Company, held on January 4th, the annual report was adopted, and the old officers and directors re-elected as follows: President, Lieut.-Col. Pellatt; vice-president, W. D. Matthews; secretary, Samuel Trees; directors, W. R. Brock, M. P., H. P. Dwight, Hon. George A. Cox, S. F. McKinnon, Thomas Walmsley, Frederic Nicholls, Robert Jaffray, Hugh Blain and W. T. Murray.

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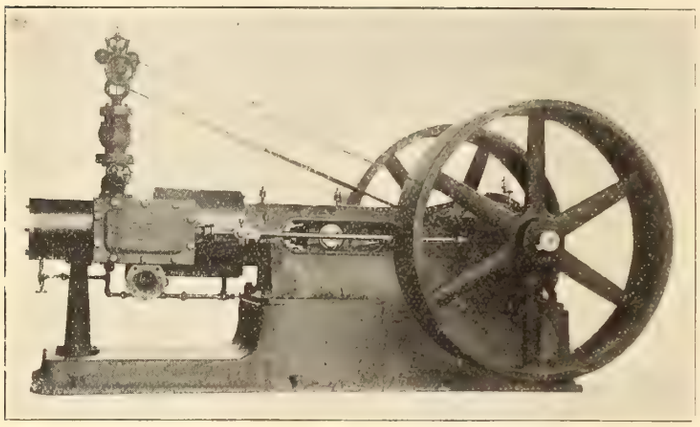
Mr. H. A. Macrae, solicitor, of Toronto, is applying for the incorporation of the Canadian Power Company, for the purpose of generating and transmitting electric current for light, heat and power purposes. The point of operations is not stated.

Owing to the recent serious accident at the C. P. R., Owen Sound, caused by an acetylene explosion, the management of the Balmy Beach Park have decided to do away with the acetylene plant and replace it with an electric plant for lighting the hotel and cottages.

At the recent annual meeting of the Canadian Society of Civil Engineers, in Montreal, Mr. Wallace. C. Johnson, C. E., delivered an interesting lecture on the water power development at Shawinigan Falls, Que., for which he is consulting engineer.

The town council of Cornwall, Ont., has decided to engage an expert to prepare plans and specifications for the electric street lighting of the town, preparatory to calling for tenders.

The Montreal Light, Heat & Power Company have received the authorization of the shareholders to issue bonds for $7,500,000, of which $2,500,000 will be issued immediately. Of this amount $2,000,000 is to redeem the Chambly bonds, and the balance for improvements to the plant. It is learned that the entire power capable of being developed at the Chambly plant is 20,000 horse power, half of which is now being delivered, while the balance will, it is expected, be marketed next summer. The loss in transmission of the power is said to be about 15 per cent. It is understood that the east end and the Imperial steam power plants are to be closed down and concentrated at the Queen street station, where there will be 6,000 horse-power.



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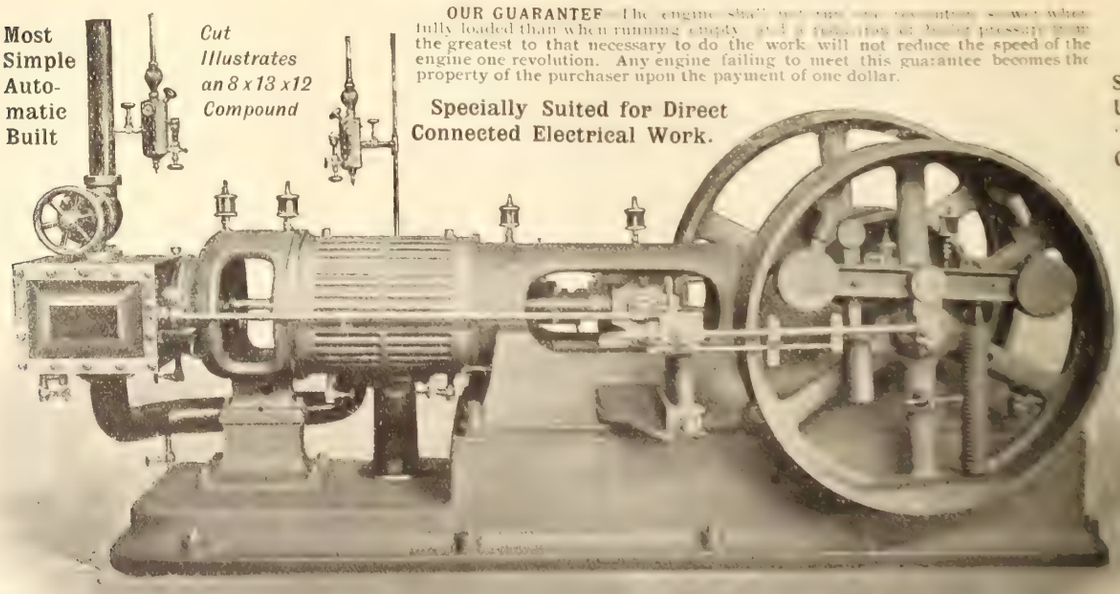
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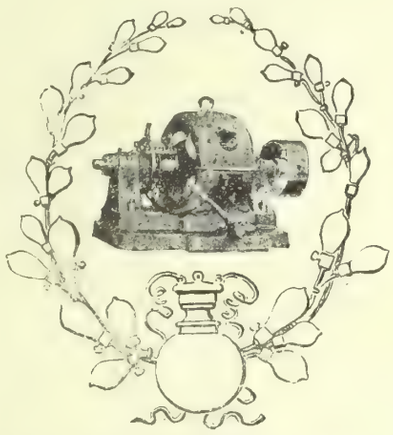
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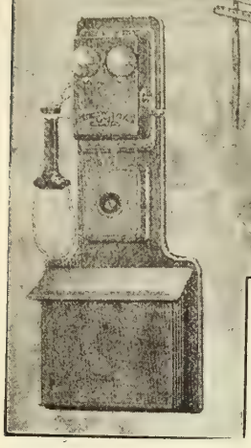
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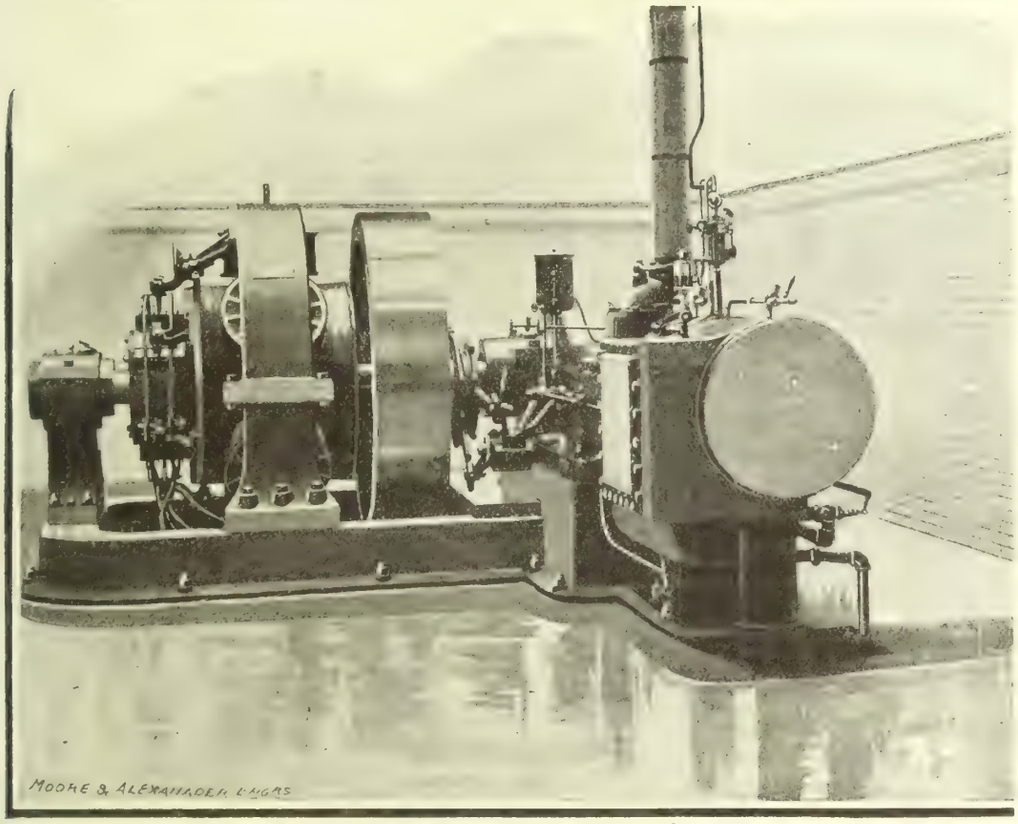
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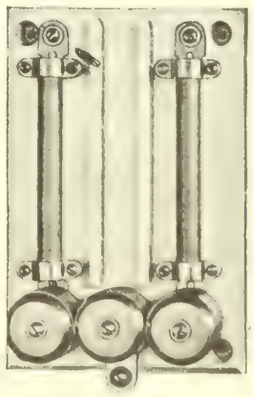
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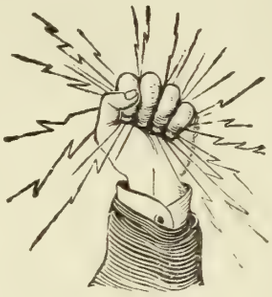
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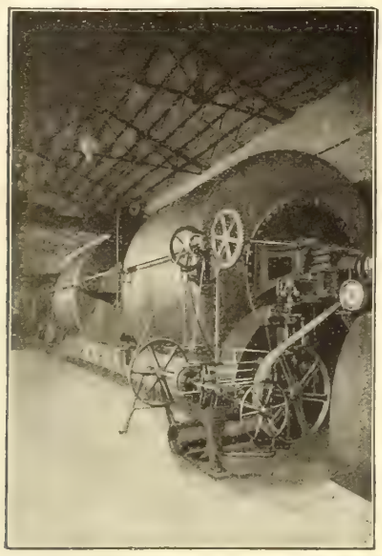
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WRITE FOR CATALOG. DEPARTMENT E.

SPARKS.

Tenders are about to be invited for lighting the town of Aylmer, Que., by electricity.

An effort is being made to form a company to install an electric light plant at Masonville, Que.

Robert Glover, aged 20, came into contact with a live electric wire at the blast furnaces at Sydney, N. S., and was instantly killed.

Mr. C. G. Cunningham, electrician, of Greenwood, B. C., has just completed the installation of an electric light plant of 80 lights capacity at the Snowshoe Mine, in Greenwood camp.

The Electric Cab Company, of Toronto, is being wound up. The statement of the company showed liabilities of $7,300 and assets of $12,500, the latter consisting mostly of electric cabs.

There is an agitation at Grand Falls, N. B., in favor of the introduction of a system of waterworks and electric light. It is rumored that a joint stock company will be formed for the purpose.

Mr. Frederic Nichols, manager of the Canadian General Electric Company, has presented to Ridley College, St. Catharines, Ont., a combined hall and hockey rink, which is to cost at least $5,000.

A report has been presented to the council of Toronto Junction, Ont., by Mr. Hardy, superintendent of the electric light plant, showing that the plant is obsolete, and it is probable that a new plant may be installed.

Mr. Henry Burkholder, of Chicago, states that the scheme for building an electric railroad from Winnipeg to Lac du Bonnet, Man., is making satisfactory progress. The distance is 58 mlles, and the cost will be about $20,000 per mile.

At the annual meeting of the shareholders of the Cataract Power Company last month, it was decided to increase the capital stock of the company by $50,000, for the purpose of extending the radilal railway from Burlington to Oakville.

It is understood that the promoters of the proposed electric railway between Winnipeg and Headingly, Man., have secured right of way in the outlying municipalities and have undertaken to construct the line as far as Sturgeon Creek this year and t complete the remaining portion next year.

The Sarnia Gas & Electric Light Company, Sarnia, Ont., are having plans prepared for an addition to their power house and will install one 2,000 light alternator, one street railway generator, and one cross compound engine of 450 h. p.

The Pittsburg Reduction Company will largely increase their plant at Shawinigan Falls, Que. About 5,000 horse power is now used for the manufacture of aluminum, and the company purposes engaging in the manufacture of wires and cables also.

The Dominion Coal Company, of Sydney, N. S., in order to capture a part of the coal trade of Northern Europe, is sending a number of Canadian railway firemen to Norway to demonstrate how successfully our coal may be used on locomotives. The firemen will spend several months in Norway and other northern countries.

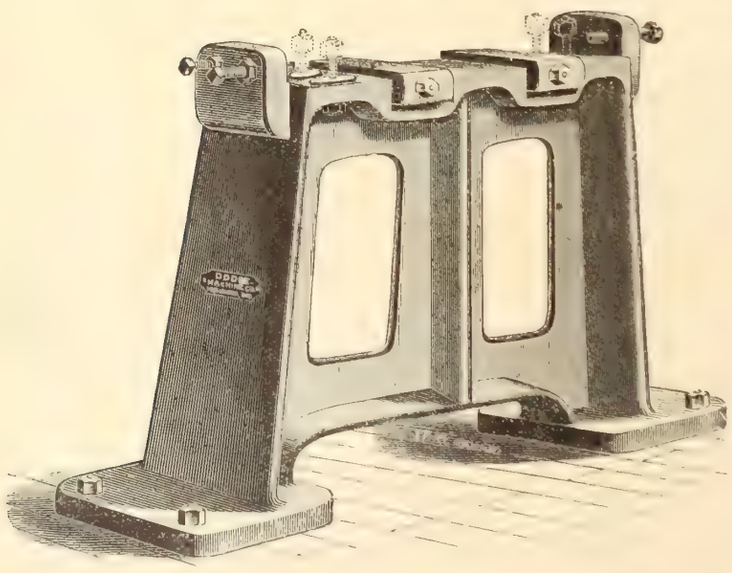
The New Hamburg Electric Light Company, of which Mr. Jacob Morley is proprietor, is making preparations to extend the lighting system to Baden, two and one-half miles distant, having secured the necessary franchise and right of way. Mr. Morley will increase his steam and electric plant for the purpose this summer.

Messrs. N. T. Tanguay, of Weedon, Que., Louis I. Lafleur, of Montreal, and others are seeking incorporation as the St. Francis Hydraulic Company, to develop for electrical purposes the water power of the St. Francis river, between the villages of D'Israeli and St. Francis, and for the purpose of distributing power within a radius of thirty miles.

The Brandon Electric Light Company have submitted a new tender for lighting the streets of Brandon, Man. They agree to erect and maintain a system of standard enclosed arc lights of 2,000 nominal candle power, to be lighted from dusk to daylight, for the sum of $120 per lamp per year, and to erect and maintain 50-candle power incandescent lamps for the sum of $40 per light per year. The system of arc lighting will entail a heavy outlay on the part of the company in erecting lines and purchase of arc lamps, transformers, etc.

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NOTICE TO SUBSCRIBERS.

The publishers of the "ELECTRICAL NEWS" will pay 25 cents to the subscriber or reader who will first supply them with a copy of the "ELECTRICAL NEWS" for April, 1899.

PERSONAL.

Mr. J. Roderick Robertson, one of the promoters of the Cascade Water Power & Light Company at Cascade, B.C., died last month.

Mr. W. H. Dowsley has accepted the business management of the electric light and gas plants operated by the corporation of Belleville, Ont.

Mr. J. H. Ward has resigned his position with the Hensall Electric Light Company to become engineer for the New Hamburg Brass Manufacturing Company, of New Hamburg, Ont., a new industry to be started this month.

Mr. John W. Moyes, manager of the Metropolitan Street Railway, which extends from Toronto to Newmarket, has been nominated by the Conservatives of East York to contest that riding at the forthcoming election for the Ontario Legislature.

A pleasant event took place in the Montreal office of the Light, Heat & Power Company recently, the occasion being the presentation of a silver loving cup to Mr. W. H. Browne by the employees of the old Royal Electric Company, of which Mr. Browne was general superintendent. Mr. P. G. Gossler acted as spokesman expressing regret at Mr. Browne's departure and wishing him success in his new field. Mr. Browne fittingly thanked the donors.

STORAGE BATTERIES

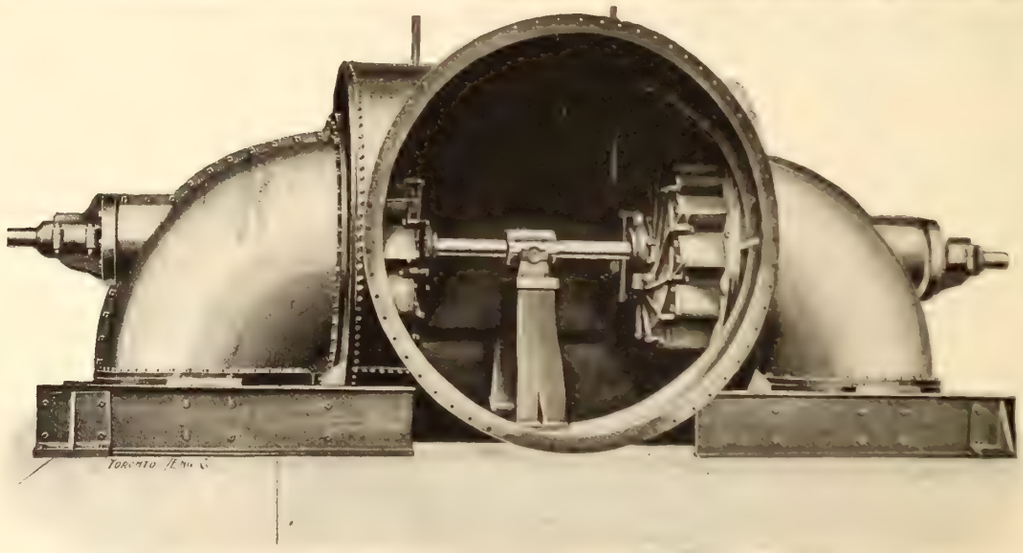
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This company carries in Pittsburgh a large stock of Type K transformers. Shipments via Buffalo enter Canada on the second day after shipment, thus permitting quick delivery to Ontario and Quebec points. Inquiries for prices and publications should be addressed direct to this company.

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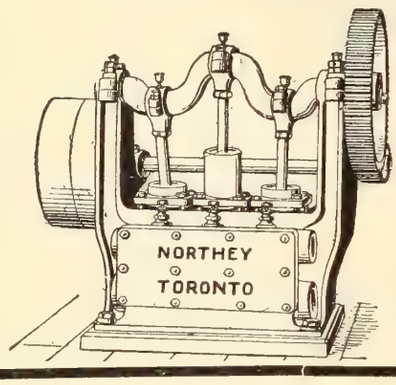
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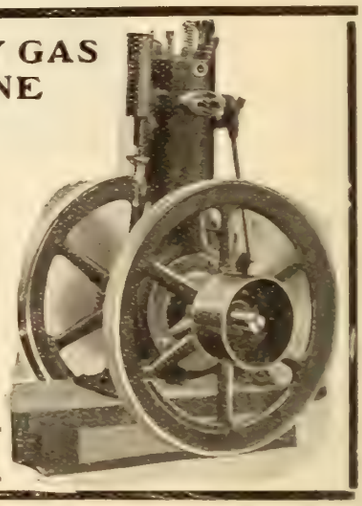
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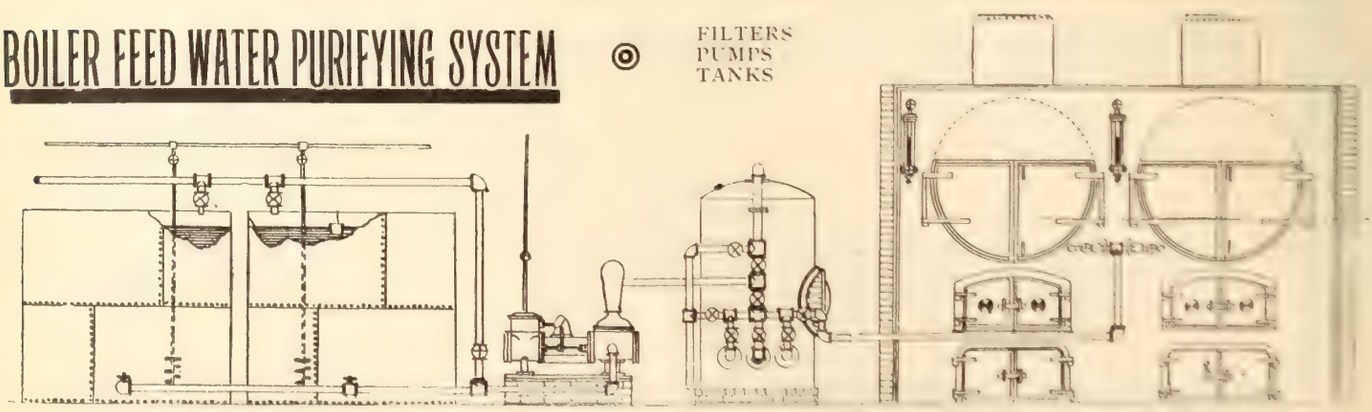
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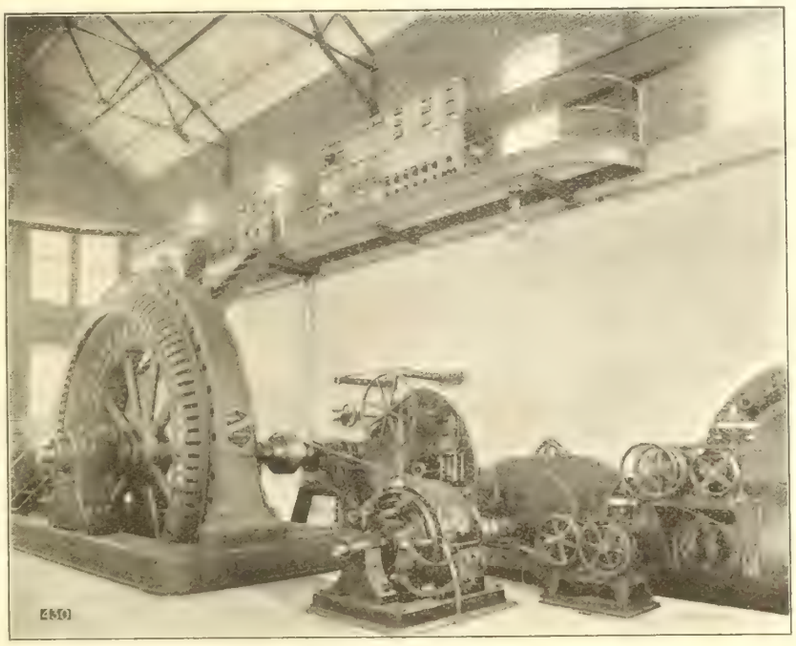
ENGINEERING JOURNAL.

VOL. XII. MARCH, 1902 No. 3.

SHEIK'S ISLAND POWER PLANT.

By F. H. LEONARD, JR., E. E.

On the 11th of January, 1902, a party of prominent engineers and managers of electric power plants, were the guests of the Bullock Electric Manufacturing Company, of Cincinnati, Ohio, on a trip to visit the power plant designed for Mr. M. P. Davis by Messrs. T. Pringle & Son, of Montreal. A special Pullman car took the party from Montreal and was met at Cornwall by Mr. Davis, who had brought with him from Ottawa in a special Pullman car, some of his friends and a number of Government officials. The whole party drove in open sleighs from Cornwall, along the canal bank, to the power house at Milleroches, a distance of about six miles, inspecting on the way the construction of the transmission line and arc lamps hung for lighting the canal banks and locks and the switch cabins and transformer houses placed at the various locks for controlling the electrically operated mechanism for opening and closing the gates and operating the weirs.



SHEIK'S ISLAND POWER PLANT GENERATOR AND EXCITER.

The photograph representing the parties present, gives a glimpse of the interior of the power house, and another photograph shows one of the 1000 k. w. generators and exciters in place direct connected to the water wheel shafts. Three additional units similar to this are to be installed later. A view of the switch-board shows the general arrangement of machine and main exciter and feeder panels, as well as the arrangement of the arc switch-board and induction regulators.

The large rotating field generator has a capacity of 1,000 k. w., or about 1350 h. p., and runs at 180 r. p. m., having 40 poles, gives a frequency of 60 cycles per second, delivering current at the buss bars at a potential of2 ,200 volts.

The exciters have a capacity of 50 k. w. and are sufficient to excite four generators similar to the one described above. Two exciters have already been installed, so that in case of accident to the exciter or wheels connected with it, the other unit can be immediately put into operation to take the place of one which might have been accidentally disabled.

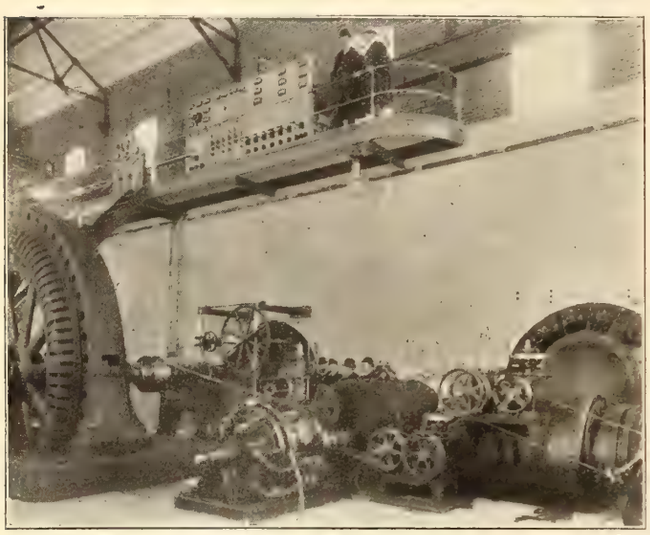
At the switch-board connections are made with cables leading to the wire tower, on the second floor of which are located the raising transformers which increase the pressure from 2,200 volts to 11,000 volts for the power transmission circuits, and to 8,800 volts for use in connection with the 100 light circuits of series enclosed alternating arc lamps, 250 of which are at present distributed along the canal banks and at the locks, bridges and guard gates for lighting the Cornwall canal. The power circuits distribute current for operating canal gates, swinging the bridges and controlling the weirs at the various points from lock No. 15 to lock No. 21, a distance of about 11 miles, step-down transformers being provided at the locks to reduce the line pressure from 11,000 volts to 550 volts, at which it is used in the induction motors. This work does not utilize the full capacity of one generator, but it is proposed to shortly install additional generator capacity so as to provide power for other enterprises which are now operating by steam, or which may later be attracted to the spot by moderate price power delivered electrically in shape ready for utilization in various classes of industry.

The power house building is 40 feet by 90 feet, built of brick above the line of cut stone arches over the tail-race, and has a steel frame which supports a 25 ton travelling crane running the whole length of the building, and is covered by a steel trussed roof of heavy plank, the whole construction being practically fireproof.

On the side of the power house next to the head-race is located a steel framed tower, 13 feet by 15 feet, with

brick walls three stories in height, the lower story of which is occupied by the high potential switchboard, the next story with step-up transformers, and the top story is devoted to lightning arresters and distributing the ends of the cables onto arms which support the transmission lines so that they leave the tower from the two opposite sides to serve lines running in opposite directions from the power house.

The main floor of the power house is occupied by the generators, exciters and governors for the water



Sheik's Island Power Plant.—Switchboard Gallery.

wheels, the bulkhead extending about 8 feet into the power house, the top of which at an elevation of about 19 feet above the main floor, serves as a switchboard gallery, the width being increased about 4 feet by brackets, over which the floor is extended, communication between the gallery and main floor being obtained by means of an iron staircase at the centre with brass railing, which also extends around the gallery to both ends of the power house where there are iron ladders on the face of the bulkhead, giving additional means of communication from the generating floor to the switchboard gallery.

The switchboard is of the Wagner type, with illuminated dial dead beat instruments for indicating the current in each phase on the generator panel, a volt-meter switch being provided so the single volt-meter indicates the voltage on any phase. Totalling watt-meters are also located on the generator panels, as well as static ground detector, synchronizing lamps and main switch of the oil type and double brake knife switch for generator fields. A double-throw switch provides for lighting the station either from the exciter circuits or from a transformer on the generator circuit.

The exciter panel has a D.C. voltmeter and ammeters for each exciter with double throw switch so either exciter can be used with any generator or both can be run together to excite all the generators.

The feeder panels have ammeters in each phase and oil switches for opening and closing the circuits, as well as expulsion fuse blocks in each phase. One panel feeds the Milleroches power and lighting circuit at 2,200 volts, another connects the 11,000 volt, step-up, air cooled transformers in the tower with the 2,200 V. bus-bars, while another connects the three 60 k.w., 8,800 V. arc lighting transformers to the bus bars, space being left for five additional feeder panels.

The arc switchboard and generators are located beyond the space left for additional generator panels at the left of the gallery, the circuits being controlled by plug switches which are also used for making up connections to the transformers. Hot wire ammeters are used to indicate the current in each circuit and a static ground detector provided with plugs for each circuit.

The arc regulators are finely finished with blue Vermont marble tops to match the switchboards and polished brass trimmings.

In the lower floor of the tower is located a high tension plug switchboard with enclosed fuses for making up circuits on the 11,000 v. power lines and for connecting primaries of transformers to cables ; but these switches will seldom, if ever, be used for opening circuits as the oil switches on the main switchboard will serve to open the circuit on the low tension side at the bus bars. It is expected later to install dummy panels in the main switchboard to operate electrically controlled automatic overload switches built in brick compartments in the tower.

The lead covered cables connecting the dynamos and exciters with the switchboard are hung in brackets located in trenches left in the concrete and ascend on the face of the bulkhead, where they are distributed from a central point in either direction through a trench back of the switchboard, which is covered with hardwood gratings oiled and shellaced. The cables are also supported in brackets and stanchions in regular order in this trench, which also conducts the cables from the switchboard into the space below the ground floor of the wire tower, up the sides of which the cables are supported on insulating brackets until they reach the top floor where the three wires in each cable are separated at the cable heads and connected to the outside lines on the arms inside near the ceiling of the top floor. Iron



The Party who Visited the Sheik's Island Power Plant on January 11th, 1902.

brackets outside of the tower near the top support two timbers, one above the other, into which the insulator pins are inserted, below which a platform outside the upper windows is located at a convenient height, making the wires accessible for connections, etc.

The line construction is plain, and substantial shaved cedar poles are used with the exception of a few iron structures at the bridge piers and locks. All poles are exceptionally straight and stocky and are located 100 feet apart on the canal banks, each pole being lo-

cated and lined by the Government engineers. All poles on curves are guyed with galvanized signal strand and where guy stubs are not used two globe strain insulators are used to insulate the guys anchored in the ground. All the poles are painted and lamp poles are are stepped and pipe brackets 2½ feet long support the lamps which are hung on Cutter porcelain insulating hangers, in addition to the loop and porcelain insulator on the lamp.

Six pin arms are used on the line with pins 16″ on centres and braced with steel braces. Double arms are used on all sharp turns bolted through the poles and at the ends. The upper cross-arm carries the two three phase 11,000 v. lines and the arm below carries the arc circuits except near the two ends of the line where one-half of the arm is used for three phase and the other for arc circuits. No. 6 (medium hard drawn) bare copper wire is used for both arc circuits and power feeders, supported on 4½″ triple petticoat glass insulators tied on top.

The total line drop is about 5 per cent., and in some cases less, but on account of mechanical strength it was not deemed advisable to reduce the size of the copper. A line of barbed wire is stretched the whole length of the line on insulators on the pole tops and grounded at every fourth pole as a protection from lightning, though lightning arresters are provided at the power house and at the cable crossings. The high potential lines cross the canal in paper insulated lead covered and armoured cables and provision is made for tying the lines together at various points so that in case of break down the lines can be connected so as to work around the point in trouble.

At each lock little sub-stations or cabins are located to contain the transformer fuse boards and switchboards for controlling the motors for operating the gates, etc. These cabins also serve to cover the joint in the cables, which passing through the floor go underground to the masonry walls of the locks, then through the course below the coping stone and down the spare stop log checks at the head of the lock, crossing on the bottom out of danger of injury, as they are below the level of the top of the breast wall and covered with a 10″ x 12″ timber, thence up the other side in the check in the masonry to the same level as the starting point, then through the wall and earth into another switch-board cabin on the island between the two locks. The motors on each side of the two locks and at the weirs being controlled from separate switch-boards, though the cabins between the two locks side by side, contain switches for motors operating one side of each lock.

The three-phase high potential is reduced in a bank of three Packard tranformers from 11,000 to 550 volts and only the lower voltage distributed about each group of locks except for series arc lighting which crosses back and forth for each lock and bridge pier. Near the easterly end of the line a spare cable is laid across in a trench dug in the mud bottom of the canal to connect the circuits on the north bank to the south bank in case of trouble in either line.

The horizontal water wheels for this plant were furnished by the Wm. Hamilton Manufacturing Company, Limited, of Peterborough, Ont., and operate under a working head of 30 feet. They are arranged in two pairs with a fifth wheel used only in case of high back water, the draft tubes of which pass through the concrete arches below the floor of the power house and empty into what was formerly the river bed of the St. Lawrence, a dam having been built just above the power house by the Government for the purpose of widening the canal, which cuts off the channel between the Canadian shore and Shiek's island, leaving a large lake on the upstream side of the power house, so that with the still water in this lake troubles from ice, which are such frequent evils in connection with most Canadian power plants, will be entirely overcome.

The Cornwall canal is part of the deep waterway system of the St. Lawrence connecting the great lakes with ocean navigation at Montreal, and has locks capable of handling vessels 250 feet long, 50 feet wide and drawing 14 feet of water.

The head race for M. P. Davis's power house is cut from the broad channel leading to the canal waste weir and is paved with stone on a slope of 2 to 1 to protect the banks. A steel frame supports the fine racks, back of which are located the head gates operated by heavy gearing which admit of cutting off the water from any of the four wheel chambers to admit of inspection or repairs of any of the wheels. Valves are provided for drawing off the water after the gates are closed as well as valves for refilling. The gates on the wheels are operated by rods passing through the plates in the bulkhead where they are attached to the Lombard governors for regulating the speed.

Lunch was served at the power house, after which many speeches were made, expressing admiration of Mr. Davis's enterprise and the neat and substantial construction of the power house, as well as the care shown in arrangement of details for convenience of operation and control. Much admiration was also expressed in connection with the Bullock generator and the arc lighting system of the General Incandescent Arc Light Company, of New York.

The return to Montreal was made interesting by the impromptu entertainments and unflagging vigor of Messrs. Aberdee, Lozier and Collyer, representatives of the sales organization of the Bullock Wagner Manufacturing Company.

MR. WILLIAM CLARK HAWKINS.

Perhaps there is no greater organization in Canada identified with electricity than the Hamilton Electric Light & Cataract Power Company, of Hamilton, Ontario. This company controls and operates the Cataract Power Company, Hamilton Electric Light & Power Company, the Electric Power and Manufacturing Company, Hamilton Street Railway, Hamilton Radial Electric Railway, and Hamilton & Dundas Street Railway. The electric power for the operation of these systems is obtained, as is generally known, from a water power plant at DeCew Falls, near St. Catharines, the current being transmitted to Hamilton, a distance of over 30 miles.

About nine months ago the management of the Hamilton Electric Light & Cataract Power Company was placed in the hands of Mr. W. C. Hawkins, whose portrait is shown herewith. Mr. Hawkins brought to his new position a wide and varied experience. His early days, until 1884, were spent at Taunton, Mass., in the fall of which year a course at the Steven's Institute of Technology at Hoboken was begun. After graduation he spent one year in a machine shop as

machinist and a draftroom as draftsman with a firm of printing press manufacturers. For the next year he was employed as assistant engineer on the Third Avenue Cable Railroad in New York City, laying out the roadbed of that company. Upon completing this commission he made a trip to Central and South America, spending the time from September to April in those countries selling and installing turbine plants and coffee cleaning machinery.

From January, 1890, until two years ago, Mr. Hawkins was connected directly or indirectly with the General Electric Company, of Schenactady, N. Y., mostly in the several central stations in which the company had interests. He acted in various capacities, being at one time or other superintendent and manager, engineer, receiver, etc., his duties being principally the physical and sometimes the financial reorganization of the local companies. Prior to coming to Hamilton in July, 1901, a year and a half was spent



Mr. William Clark Hawkins,
General Manager Hamilton Electric Light and Cataract Power Co

at the Schenectady works, principally along the line of engineering.

In his new field Mr. Hawkins will have abundant scope for the utilization of his extended knowledge which so ably qualifies him for the position he has accepted. While he is general manager of the company, it is probable that he will devote special attention to light and power.

ELECTRIC PLANT AT THE ROYAL MILITARY COLLEGE.

The Militia Department has added to the equipment of the Royal Military College at Kingston an electric lighting plant. The installation was carried out by Messrs. Breck & Halliday, the well known electricians of that city. The plant consists of two direct-connected units and sixty chloride accumulator cells. The generators are of the very latest C. G. type, known as form L. They have a capacity of 25 kilowatts each at 125 volts, and a speed of 305 revolutions. These generators have the improved form of brush holders, with hand wheel adjustment. They are connected to 9 x 10 Ideal engines, manufactured by the Goldie & McCulloch Company, of Galt.

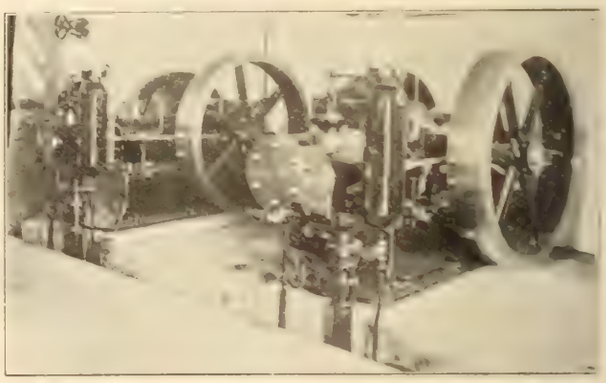
The switch-board is a fine piece of work. It consists of three panels of blue Vermont marble, each 62 x 24 inches and 2 inches thick. Each generator panel is equipped with a Weston round pattern volt and ammeter, ground detector, dynamo and circuit switches, rheostats, etc. There is a storage battery panel, with two divided scale Whitney ammeters and one C. G. E. estatic voltmeter. There are also a



Kingston Royal Military College—Power House.

main charging rheostat and equalizing rheostat. A double pole, double throw charge and discharge switch, main battery switch, and I. T. E. underload and overload circuit breakers are features of the battery panel. The entire switch-board is equipped throughout with Sach's "Noark" fuses.

The storage battery consists of sixty cells (chloride accumulator), having a capacity of 400 ampere hours, with a normal discharge rating of 50 amperes. The battery is located in the dynamo room and enclosed in a glass partition. All connections inside the battery room are made with lead encased cables. The



Kingston Royal Military College—Engines and Generators.

battery voltage is regulated by means of a Crouse Hinds end cell switch. The charging of the battery is accomplished during the time of lighting by throwing the cells into two series parallel groups of thirty cells each. The current is controlled by means of a large Cutler Hamer rheostat in the main circuit. An equalizing rheostat of the same type is also placed in the charging circuit to regulate the current passing through each series of cells. After 11 p.m. the load will be comparatively light and will be carried by the storage battery, which will be charged during the hours of lighting when the load on the dynamos is light.

The Militia Department has under consideration the

advisability of installing an electric pump in the college for fire protection. At present the Kingston Fire Brigade, one mile from the college, has to be depended upon. In the event of the electric pump being placed in position, the storage battery, which will always be kept fully charged, will be utilized to operate the pump motor until such time as steam can be raised and the engines started.

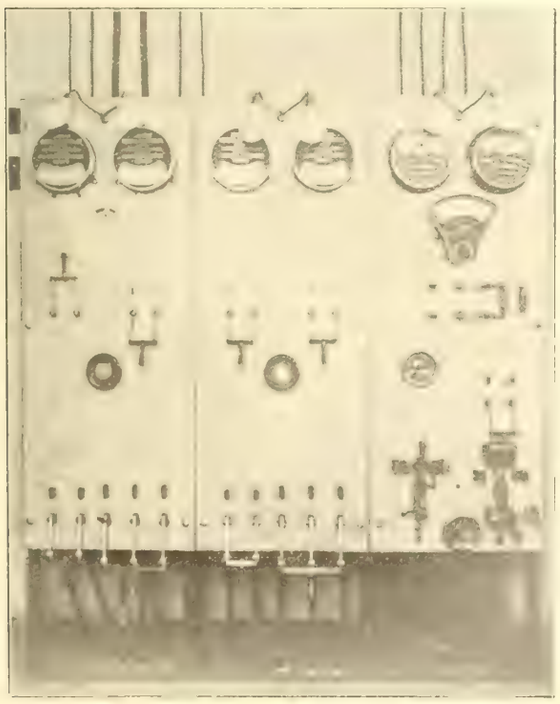
The power house is situated about 1,500 feet from



KINGSTON ROYAL MILITARY COLLEGE—BATTERY ROOM.

the main building. The current is carried to this building by a 500,000 C. M. cable. The gymnasium, officers' quarters, and hospital are fed from a centre of distribution in this building. There are three separate lines from the power house to supply the avenue, the dormitory buildings and the servants' quarters.

The boiler plant is made up of two shell boilers, each 14 feet long, 48 inches in diameter, of 50 horse power, and equipped throughout with brass mountings.



KINGSTON ROYAL MILITARY COLLEGE—SWITCHBOARD.

They were built by Messrs. Selby & Youlden, of the Kingston Foundry. Improved Penberthy injectors are used as an auxiliary to the feed pump. There is also a heater in connection with the plant. Government standard pop safety valves are connected with the boilers. All steam piping is encased in magnesia covering, and steam separators are connected to the engines.

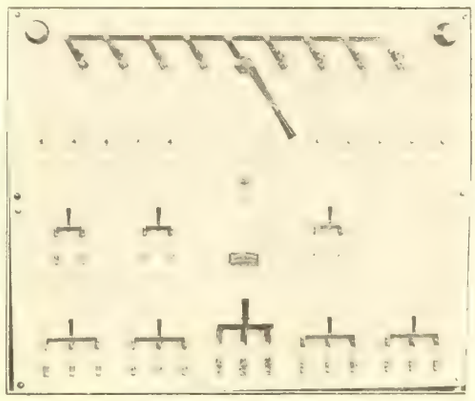
The college buildings are wired for 500 lights of 16 candle-power. The grounds and avenues throughout are at night brilliantly illuminated by arc and incandescent lamps. The plant cost between $8,000 and $10,000, and is the most modern that could be purchased.

The photographs from which the accompanying illustrations were made were taken by Mr. Harry Breck, Kingston.

ELECTRICAL EQUIPMENT OF AN OPERA HOUSE.

Messrs. Breck & Halliday, electricians, have just completed the electrical equipment of the new Grand Opera House in Kingston. The work is quite unique and a credit to the contractors.

The electric power for the opera house is supplied by the Kingston Light, Heat & Power Company, whose plant is situated on Queen street, one-quarter of a mile from the theatre. The switch-board is located at the left side of the stage. It is of the purest white Italian marble, 4 x 5 feet in size, and 1¼ inches thick, and consist of two panels. In addition to the ordinary knife switches, there is a gang of Chase-Shawmut interlocking theatre switches. Ward Leonard dimmers are used, having the interlocking mechanism. The



KINGSTON OPERA HOUSE—SWITCHBOARD.

board controls 650 lights, of which one-half are on the stage. Between the various borders, curtains, etc., are four rows of border illuminations, each row 27 feet long, with white, green and red lights, 59 lamps to the row. The foot lights are also wired in white, green and red colors. Connection is made throughout the house for electric calcium light for special effect. The rows and clustered brackets of rosette lamps throughout the house are exceedingly beautiful, and the result is an illumination of surpassing brilliancy.

A word about the distribution of the lights may be of interest. In the entry way they are in two rows in flower form. In the main part of the house are ten two light brackets, and on the walls and under the galleries 36 rosette lights. Fronting the balcony and gallery are fifty lights in flower form. Over the proscenium front are two rows of thirty and twenty lights respectively. On the stage is every modern device for making theatrical effects, such as moonlight scenes, lightning in a storm, sunrise and sunset, explosions, and calcium colored specialties for tableaux and dancing, etc. Electric bells and gongs are quite numerous.

The wiring is both outside and concealed work, mostly the last named, and under the woodwork and plastering. The wires are all rubber covered. Every precaution is taken again short circuits, and the wires are all arranged in such a locality and way that in case of fire any wire in the building can be located in a moment. They are kept from the plastering and woodwork by porcelain tubes and knobs.

Stage managers from different places, who have visited the opera house, say the electrical fixtures and appliances are superior to those in any other theatre in Canada.

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EDITOR'S ANNOUNCEMENTS.

Correspondence is invited upon all topics coming legitimately within the scope of this journal.

The "Canadian Electrical News" has been appointed the official paper of the Canadian Electrical Association.

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Electric Railway Commission.

A bill has been introduced in the Ontario Legislature by the Hon. J. M. Gibson, Attorney-General, providing for the appointment of a committee to be composed of the Commissioner of Public Works, (chairman) the Attorney-General and the Commissioner of Crown Lands, with similar powers to those of the Railway Committee of the Privy Council. It is quite proper that electric as well as steam railways should be made subject to control, care being exercised, however, that such control shall not become oppressive and a clog upon enterprise. A stop should certainly be put to franchise and stock gambling, such as has too largely prevailed in the past.

An Interesting Tunnel Project.

The Pennsylvania Railroad Company have decided to solve the problem of access to and exit from New York by the construction of immense tunnels, and have rejected the alternative proposal of the building of bridges across the North and East rivers. The terminal system will be of the most interesting type, and will be operated by electricity, and ventilated partly by the moving of the trains. The president of the Pennsylvania Railroad Company states that after years of exhaustive study, the conclusion has been reached that a tunnel operated by electricity is in every way the most practical, economical and best. The tunnelling of the North river will present many difficulties, for the bed of the river is said to be a soft mass of clay and mud for about 75 feet in depth. The plan proposed might be termed submarine bridge building. A bridge will be built beneath the river bed, supported on piers which will rest on the solid rock, these structures are to be closed in a steel tube. The bridge and the tube, it is intended, shall be constructed simultaneously, and when the time comes for a pier, one will be sunk to the rock and the bridge extended over to rest upon it. Accordingly, the piers and the bridge work and not the tube, will bear the weight of the train. The tunnels will take three years to build and will cost in the neighborhood of fifty million dollars. By some it is predicted that the experience that will be derived by the Pennsylvania Railroad Company in the operation of this portion of their road will result in the adoption of electricity as the motive power on the entire system.

Rights of Electric Companies.

Two judgments have been rendered during the past month which define the rights of electric lighting and power companies under municipal franchises. In the Trial Court at Ottawa, the Ottawa Electric Company brought an action to restrain the Consumers Electric Company from erecting and maintaining poles or wires on certain streets in the city in such proximity to the poles and wires of the Ottawa Company as to interfere with the working of their system. Both companies were granted a franchise by the corporation to erect poles and wires. The Ottawa Company were the first occupants of the streets, although they did not possess an exclusive right or privilege to the use of the streets. The judge held that being first in occupation and using the streets under authority conferred by the corporation, the Ottawa Company were entitled to protection against a company subsequently under like authority using the streets in such a manner as to in-

jure the property of the first occupant. It was further decided, upon evidence submitted, that three feet may be regarded as a safe distance between primary and secondary wires, but that two secondary wires may parallel each other at a distance of from six to nine inches without the slightest danger. The defendants were directed to remove all poles and wires within three feet of those of the plaintiff and were restrained from in future erecting poles or stringing wires closer than three feet to those of the plaintiff. In the case of the Quebec Railway, Light & Power Company vs. The Jacques Cartier Power Company, of Quebec, the decision is by the Court of Appeals. The circumstances are similar to those in Ottawa, excepting that the principal grievance of the plaintiffs is on account of the placing of wires by the Jacques Cartier Company above or under those of the Quebec Company. The defendants were instructed to remove their poles to a distance of three feet from those of the Quebec Company, this decision being in accord with the ruling of Judge McMahon in the Ottawa case. The question of the position of the wires of one company above or under those of another company was, however, regarded in a different light. It was pointed out by the judge that when wires are perfectly isolated they can be placed very close together without danger, but that they do not remain isolated for a long period, as the substance surrounding the wire will deteriorate, nor was the required distance for safety always the same. The accidents which happen might take place when there was only one company, since their wires are one above the other in the same vertical position. The plaintiffs contended that they were not obliged to accept an additional risk from another company, but the judge held that if that proposition were true, no two systems of electricity on the surface of the earth, in the same street, could exist without an understanding between the two companies. Competition would not be possible, and under such circumstances an electric company could not establish itself where telegraph or telegraph wires exist. The evidence, he held, did not establish the existence of any real, actual or immenent danger which would be a violation of the acquired rights of the Quebec company. The opinion of one judge was that the distance between primary wires should at least be six feet, and that crossings should be made at a distance of not more ten feet from a pole. But as experts admitted that even if this plan were adopted the danger would still exist, Chief Justice Lacoste of the Court of Appeals, ruled that the Jacques Cartier Company, were not in fault when their wires and poles were a distance of three feet apart. If we interpret the judgment properly, it is that where an electrical company has priority of occupation, another electrical company is restrained from placing its poles within three feet of the poles of the original company, but that the law will not protect the wires of one company from interruption by those of another company as the result of their being placed too close.

The bill to incorporate the Ontario Electric Railway Company has been passed by the Ontario Legislature. This company proposes to build an electric railway from Cornwall to Toronto and from Brockville to Ottawa, the capital stock to be $5,000,000, bonding power $20,000 per mile, and expected cost of construction $8,000,000. The first directors are Sir Richard Cartwright, Cornelius Birmingham, Robert Carson, and John Carson, of Kingston; A. L. Jewell and George E. Smith, of Boston; and H. W. Smith, of Salem. The head office is to be in Kingston.

FAST VS. SLOW RUNNING ELECTRIC METERS.

While in the United States 25 per cent. of lost current is charged to slow running meters, and the experience of most lighting companies in Canada seems to show that slow running meters are the rule, the report of the government Inspection Department at Ottawa states that the greater number of electric meters tested were found to run fast. Mr. Higman, chief electrical engineer, whose attention was called to this circumstance, writes the following in explanation :—

OTTAWA, February 7th, 1902.

To the Editor of the CANADIAN ELECTRICAL NEWS.

SIR,—In reply to your letter of the 5th instant, I beg to state that the departmental report in question is made up of returns furnished by the inspectors from actual tests made. A certificate of the test of each meter showing the percentage of error—fast or slow—is furnished to the supply company and there would seem to be little excuse for views being entertained contrary to the facts which these certificates disclose.

The following tabulated statement has been carefully prepared from quarterly returns made by the inspectors during the fiscal year ended on 30th June, 1901.

Districts.	Number presented.	Verified as coming within the Error tolerated by Law.			Rejected.			Verified after first reject'n as coming within the Error tolerated by Law.		
		Correct.	Fast.	Slow.	Unsound.	Fast.	Slow.	Correct.	Fast.	Slow.
Belleville	205	140	37	28						
Hamilton	578	404	42	72						
London	422	109	177	145		1	2	1		
Ottawa	809	80	249	462	6	2	4			
Toronto	791	109	282	170		1		62	55	78
Montreal	2,212	1,209	671	109	47	6	10	2	6	5
Quebec	1,183	364	574	102	2			1		
Sherbrooke	180	30	54	55						
St. John	308	73	205	120						
Halifax	158	38	97	16	2	23	4	5	2	1
Winnipeg	264	71	45	118						
Vancouver	691	229	177	288	1					
Victoria	340	98	149	102						
Totals	8,923	3,478	2,759	2,297	57	31	20	71	123	84

The meters shown under the heading "Verified as coming within the error tolerated by law" are really all correct, that is they were found legally to be either fast or slow, all being within the 3% allowed by the law. As an illustration let us take the work done in the Belleville district. The total number of meters presented was 205; of this number 140 were exactly right, 37 were less than 3% fast and 28 were less than 3% slow, but all were really correct under the law. The bulk of these meters are adjusted and tested by the supply companies before being submitted to the inspector for his test and if they run a little fast or slow it is because they have been so adjusted. A number of the companies prefer to send out their meters slightly fast in orde to compensate for the tendancy to slow up. Meters under the heading "Rejected" are mostly disputed meters and com directly from the consumer. Those coming under the head "Verified after first rejection, etc.," are of the same class but were not unsound and after being adjusted by the owners, tested out as shown.

It will be observed that out of a total of 8,923 meters presented 8,534 were found to be correct, leaving 389 or less than 5% for repairs and readjustment. This good showing is due, doubtless, to the Government Inspection, for if it did not exist supply companies would not give the same attention to the cleaning and adjustment of their meters that they now do. This fact was fairly well illustrated by the results of the first year's work under the Inspection Act, when nearly 50% of the meters tested were found to be incorrect. I am,

Your obedient servant,

O. HIGMAN,

Chief Electric Engineer.

The annual meeting of the Capital Power Company, Limited, was held in Ottawa on February 7th. Although only one-half of the company's plant was in operation last year, the financial report made a satisfactory showing. Officers and directors were elected as follows: President, E. B. Eddy; vice-president, Baeile Carriere; secretary-treasurer, H. A. Burbidge; A. W. Fraser and W. H. Rowley.

It is expected that work will commence this summer on the construction of the proposed electric railway between Thorold and Dunnville, Ont., for which a charter has been obtained by the Niagara District, Wellandport, and Dunnville Electric Railway Company. Messrs. James and David Battle, of Thorold, and William M. German, M. P., of Welland, are directors of the company.

QUESTIONS AND ANSWERS

"J. H. R.," Oxford, N. S. : Could you inform me what the necessary requirements are to become a member of the "Stationary Engineers' Association," and would a personal application be necessary, as in my position and circumstances that would be almost impossible. I have now had twelve years successful experience in steam and electrical engineering, but have never yet attempted to secure papers. I am in charge of the electrical plant and could only leave for a very short time.

ANS: The Ontario Association of Stationary Engineers have power to grant certificates to all who may apply and prove their efficiency by passing the examination of the Canada Association of Stationary Engineers. The latter association, by resolution of the board, in conformation with the law, are not permitted to furnish applicants with copies of previous examination papers. Any member of the Board of Examiners may examine an applicant, using the prescribed form of questions. The answers must be written by the applicant and forwarded by the examiner to the Registrar, who must show the papers to two members of the board and receive their approval before certificate is issued. Thus you will see that it is necessary that the applicant must appear in person before some member of the board. Mr. O. P. St. John, of the Boiler Inspection & Insurance Company, Toronto, is president of the Board of Examiners. The Registrar is Mr. J. G. Bain, 113 Yorkville avenue, Toronto.

"Induction" writes : I am in receipt of my copy of ELECTRICAL NEWS for February, also replies to my questions. Re full load capacity of 400 k. w generator, your answers do not compare with those received by another electrical journal, a copy of which I enclose. Please take up the questions again and give me your opinion regarding the transformers also. The question is of importance to me and I would therefore like to know why there should be a difference of opinion. The answer from the other journal I speak of is as follows : It will not be advisable to carry the current of your three-phase generator beyond its rated value, namely, 382 amperes. The kilowatt rating of the machine is based on its being run at the rated voltage, and the fact that you have reduced the field excitation or the speed, as the case may be, does not make the armature capable of standing any more than its rated current.

ANS.: We have gone over your questions again and fail to see wherein we are wrong. The heating of one part of the machine, say the armature, is affected by the rise in temperature of the field, and vice versa ; thus, if you have decreased your field current, and thus your field heating, you will get a somewhat smaller temperature elevation in the armature, or in other words, be able to carry a slightly greater armature current for the same maximum temperature. You do not ask any question about the transformers, so we are at a loss to know what is the point on which you need an explanation. If you desire detail figures on the probable performance of the plant under varying conditions, we would suggest that you consult the manufacturers, as it is not possible for anyone but them to give anything other than a general opinion.

"Reader," St. John, N. B. : Could you give me any information as to whom to apply to secure an engineer's license ?

ANS.: In order to obtain an engineer's license it is necessary to appear in person before one of the examiners of the Ontario Association of Stationary Engineers. Mr. J. G. Bain, 113 Yorkville Avenue, Toronto, is Registrar of the Association.

"A.H." writes : We have in our electric light plant an engine with a stroke of 12, engine travelling 275 r.p.m. with a piston 10⅝ inches in diameter ; boiler pressure 100 pounds ; boiler 11 feet long, 4½ feet in diameter ; fifty-four 3 inch tubes, with about one-half the shell exposed to the fire. Could you give me the horse power of engine and boiler ?

ANS.—The manufacturer's rating for a boiler and engine of the sizes you name would be about 50 h. p. for the former and 60 h.p. for the latter, these outputs being the most economical loads. If desired, they could be increased by any amount up to say 25 per cent., though the efficiency under the increased duty would be somewhat less.

"Station Manager" writes : Can you tell me whether any of the lighting companies pay their executive officers a percentage on the increase of revenue (either gross or after deducting operating expenses) in place of increase of salary as the business grows ? I have been informed that such was the case and that in some instances the officers receive a fixed salary with a percentage on the increased revenue for the current year over the previous year as a sort of bonus ; when no increase is shown no bonus is given. There are, of course, arguments for and against such a system as I mention, but I would like to find out if possible whether such a thing is done at all by any of the Canadian companies.

ANS: The custom of lighting companies is to pay straight salaries, and we know of no instance in which an arrangement of the kind you mention is in force. We shall be glad, however, to hear from any of our readers who know of any instance of the kind.

"C. W. C.," Rat Portage : I am looking for an advertisement of some electrical company who make a specialty of electrical apparatus for cooking and heating. I want to know if heating with electricity with water horse power at $5 per h. p. per year is cheaper than wood at say $3 per cord.

ANS. : It is difficult to pronounce very accurately on this question, but we would estimate that under average conditions, even at the extremely low figure of $5 per horse power year, electric heating would cost three to six times that of wood. Any of the dealers in electrical supplies will doubtless be glad to furnish you with all the information you desire on electric heating and cooking apparatus.

The Annual report of the Department of Railways contains for the first time some statistics of the electric railways of the Dominion. These total 675 miles of track. The paid-up capital of the companies is $30,070,010 ; gross earnings $8,708,881 ; working expenses, $3,328,163 ; net earnings $5,333,850. Ontario has 380 miles ; Quebec 197 miles ; British Columbia 81 miles ; Manitoba 18 miles ; New Brunswick 13 miles and Nova Scotia 10 miles.

INSPECTION OF INTERIOR WIRING.

Editor ELECTRICAL NEWS:

DEAR SIR,—In this age when all things advance with lightning speed, it becomes important to have such advances made in the proper direction, and that such advances should be safe, and as perfect as our trade, profession or art knows how. To accomplish this in the electrical business it is necessary that the ignorant public be convinced that an electric current is not so deadly a force as they at present suppose.

I have said that the public are ignorant, but I meant in the uses of electricity, as I find proof of such ignorance every day. I will endeavor to give you some of the ridiculous as well as amusing ideas of the people using electric current.

One man whose house I had occasion to inspect before our company made connection, wanted to know when was I going to bring the light, and requested that when I did "bring the light to bring it not too strong, as his eyes were weak, and he did not care for extremely bright light anyway." Another instance where a house was wired, concealed and located in that part of the city where people are supposed to be educated, I was making an extensive test for ground with a magnet; the lady of the house seemed quite interested in the operation, and I presume she was impressed with the whirl of the wheels in the box; after displaying some agitation she exclaimed: "I would not put so much electricity in the wires if I were you, because we will not be in here for a few days, and by the time we want the light it might have escaped, and we would have to send for you again." As ignorance is bliss I did not arouse her from her dream, but assured her that the current I sent into the wires was everlasting, without mentioning that our "gang" would connect the house that same day.

Another lady asked me what was the best way to get the "oil out of a 16 c. p. G. E. lamp, as she wanted to make some crochet fandangle work on it with balloon effect, and I contented her troubled brain by saying that the oil would evaporate during the process of crocheting. Another case reported to me by our "trouble man" was a complaint from a customer that they could not get light in their basement. Investigation revealed a broken wire in a stretch of about fifteen feet with no cleats. He questioned the servant, who said that she had hung up some clothes on the wire on the previous night, and that in the morning all the nice clean washing was on the floor. He cautioned her against doing this, and she replied that she never did care for that kind of a hanger as the black stuff (insulation) invariably left a stain.

Aside from the public being a little troublesome, I find there is considerable annoyance caused by the fire insurance companies. In case of re-inspecting a customer who was "connected up" when, perhaps, inspections were not so rigorous and exacting, sometimes certain insurance companies will call in an expert to get his idea as to the quality of the risk, but usually they omit the expert and his expense, and will send one of their own inspectors from the clerical staff in the office—who has graduated from licking postage stamps, and this inspector will pass some of the most dangerous electrical conditions as being perfect and assures his client that all is satisfactory. When the practical man comes on the scene, he is given the laugh; in fact, I have seen some people get very angry at me and say that the insurance inspector got there first and pronounced all things perfect. If the man in question has the assurance that all is O. K. with the insurance company, what need he care?—nothing, of course, but if he is reimbursed for a fire loss it will not make amends for burnt out transformers, loss of adjoining buildings, some perhaps containing comfortable homes, not insured, loss of life, and in fact many things which are the direct result of just such negligence.

It would be gratifying to know that such fire insurance companies would re-instate these office boy inspectors, let them go back to the postage stamp and opening of the head clerk's mail, then get practical men, who are qualified from long experience and are capable and reliable.. This will be one means of preventing "electric fires."

Now, a word as to newspaper reporters. I have known cases where the words "Electric Fire" were printed in large, black, scarehead letters in the daily papers reporting a fire supposedly originating from electric wires, where there were no wires in the building nor were there any wires within a few hundred feet of the building. In the face of such reports, circulated by the thousand, it is rather difficult to convince the timid people that electric house lighting is an improvement on the antique tallow dip, and furthermore it is one of the greatest impediments to the progress of the art, and a financial loss to those engaged in the electric light and power business, because people fear the disaster of a fire.

The botch or mushroom electrician is another source of trouble. These people sprout, and launch themselves into the trade with no preparatory training whatever. They are the greatest evil that our business has to contend with; they cut prices and take the work away from responsible contractors. They use cheap and inferior materials. Their work is rough and does not last; in fact they are a constant annoyance to all who have any dealings with them. The species of mushroom electrician has many varieties known only to inspectors who have made a study of this class. Then there is the plumber, the steamfitter, the uneducated steam engineer, the carpenter, the machinist, and last but not least, the iceman. But the most vile of all I have known is the handy man who knows it all. These parasites could be prevented from feeding off us, and the only way to accomplish this is through the Councils of our cities, by having laws passed that no incompetent man be permitted to do electrical work, and, as is done in many States across the border, all should be examined before an appointed board. If they are satisfactory a certificate is issued but not until then are they allowed to work. Also people intending to have electric light or power on their premises must get a permit, as is done now for boilers, building, etc. Is not an electrical installation as important as a steam engine and boiler? Is not precaution necessary to life and property? If so, laws should be made accordingly, either through municipal amendments of city charters, or by act of Parliament. I understand that an act respecting electric wiring is to be tried in Toronto. I wish Toronto success. Then the other cities will not be backward in following and the trade will be elevated to the level where it belongs.

Peculiar to note that in the book of the National Board of Fire Underwriters of the United States, adopted by the Canadian Board of Fire Underwriters; all through this valuable little code there are provisions made for many contingencies, principally against fire, but I have yet to see where the Canadian Board of Fire Underwriters make any provision for protecting life further than to state that a certain amount of insulation shall be used, here, there and everywhere.

During the past year a few cases have come to my notice where people where killed outright by making a grounded circuit with their body. In Montreal a short while ago a saloon keeper was killed in this manner. Again in Montreal a few months ago a man was killed in the furnace room with a ground. Then, a few weeks subsequent, a banking clerk was killed at the vault door, ground again. In all these instances there was the brass socket in evidence. Had these sockets been porcelain, or some other absolute non-conductor, these three lives would not have been lost. There seems to be a prevailing delusion that a brass socket is just the thing—so it is in its place, but it should not be used where there is the least possibility of making a contact with "grounded" conductors while being handled by living creatures. Those brass sockets should be barred out in all such cases, particularly in basements having ground or cement floors.

Some wiseacres contend that cement is a non-conductor, but that idea should be left at the seaside. Cement is not always dry, and no one can give a positive assurance that it will remain dry, even though it may be perfect at the time of inspection therefor.

It would be well for the lighting companies to find the moral—Prevention is Superior to Cure. Absolute non-conductive shell sockets are more easily obtained than the riddance of a law suit for loss of life from a broken down transformer, which in its playful moments, allows the primary voltage to get over on the secondary side.

Here endeth the first lesson.

Yours truly,

"INSPECTOR.

In our advertising columns will be found an interesting announcement by the Pittsburgh Transformer Company, of Pittsburgh, Pa. The subject matter of their display consists of the relation which exists between the durability of a transformer and its real efficiency. The well known reliability of this company's product gives special weight to the remarks made concerning tranformer performances. The company makes the claim that in the many thousand lights of transformer capacity which they have shipped to Canada annually, for the past four years, but a total of three transformers have ever been reported burning out from any cause whatever. This would indicate that their claims for the durability of the Type K are being well substantiated.

If you have any doubts about the value of the Canadian Hand Book of Steam and Electricity, drop a post card to the publishers, The C. H. Mortimer Publishing Co., of Toronto, Limited, Toronto, Canada, asking for a copy of table of contents. It is the best book in the market. Price, only 50 cents.

MONTREAL

Branch office of the CANADIAN ELECTRICAL NEWS,
Imperial Building,

MONTREAL. March 5th, 1902.

February 1st ushered in one of the worst snow-storms that we have known since the time of the relief of Ladysmith, when the Montreal Street Railway was "stalled." Although the effect in the end was virtually the same as far as the conveyance of passengers was concerned, yet the fight put up was simply grand. The general public have an idea that the Montreal Street Railway are generally caught napping by the first heavy winter snow-storm, and to a certain extent this in the past has not been far out. However, Saturday and the two following days saw a ceaseless fight. The sweepers hammered at it until brooms were well worn, ploughs assisted, shovellers, etc., night and day, and had the city been prompt (as they should have been) in removing the snow everything might have been kept running. As it was, however, pedestrians, vehicular traffic of all kinds, and the Montreal Street Railway were using the "swept centre" of the road, it being the only possible thoroughfare. This threw the cars out of schedule, besides re-depositing snow on the rails. Monday evening business men got their cars home as usual.

The Montreal Street Railway proposed to the City Counci that they remove the snow as piled to the sides of the track by the electric sweepers. At present the arrangement is that the city cart it away and the Montreal Street Railway pay their share of the expense. As the Montreal Street Railway propose to run full trains for removing snow, at night, aided by machinery (probably large scoop shovels electrically controlled and swinging in by means of motor a ton of snow at a scoop) there can be no question of the speed of such a system. Naturally there is a howl from the snow carter, but yet we have the City Surveyor's own word for it that these same carters won't come to the west end to cart the snow. The question would be settled to the benefit of interested citizens respectively by giving the west end clearing to the street railway and the east end to the man and his horse.

Some United States electrical periodicals, having quite a number of Canadian subscribers, might pause for an instant in their criticism of foreign practice. Any possible English attempt is, of course, held up to ridicule and often treated to sarcasm and unmerited abuse. If Canadians would simply drop them off and give their reasons for so doing, it might be a lesson to some of them to be a little more "just" and "cosmopolitan."

ANNUAL MEETING CANADIAN GENERAL ELECTRIC COMPANY.

The statement presented at the annual meeting of the Canadian General Electric Company, held on February 24th, shows that the volume of business transacted during the year ending December 31, 1901, was very much larger than any preceding year, and that the current year began with more orders on hand than at the beginning of any previous year. The balance at credit of profit and loss amounted to $612,028.94, which is made up of $345,990.03 profit on operating (being an advance of 30 per cent. over the year 1900), $195,000.00 premiums on new shares issued, and $71,038.91 brought forward. From this amount dividends of 10 per cent. on the common stock, and 6 per cent. on the preferred stock, amounting to $166,750.00, were paid, $100,000 transferred to contingent account, and $77,680.27 remains at the credit of profit and loss.

During the year new buildings and plant were added to the Peterborough works, the Montreal works were reorganized, and a 1,200 horse-power water-power secured at Peterborough. The completion of the new plant at Toronto Junction will, it is stated, enable the company to handle the greatly increased business in prospect.

The directors were re-elected as follows: W. R. Brock, M.P., president; H. P. Dwight, first vice-president; Frederic Nicholls, second vice-president and managing director; Hon. George A. Cox, J. K. Kerr, K. C., Rodolphe Forget, W. D. Matthews, Herbert S. Holt, E. B. Osler, M.P., Robert Jaffray, James Ross, Sir W. C. Van Horne, K.C.M.G.

ANNUAL MEETING TORONTO RAILWAY COMPANY.

A very satisfactory statement was presented at the annual meeting of the Toronto Street Railway Company recently. The company's gross earnings for the year 1901 amounted to $1,661,017.50, an increase of $160,016.22 over the previous year. The operating expenses were $857,612.10, an increase of $81,931.28 over 1900. The operating expenses were 51.6 per cent. of gross earnings, against 51 per cent. for 1900. The increase was due to an increase in the wages of employees and to the operation of an additional number of cars. The net earnings were $803,405.40, an increase of $78,384.94 over 1900. The statement showed a net profit of $510,726.92, as compared with $454,162.85 for the previous year. After deducting pavement charges paid to the city and dividends of 4½ per cent., the balance is $172,726.92.

During 1901 the company carried 39,848,087 passengers, or 3,786,220 more than in 1900. The transfers granted show an increase of 1,179,334.

The rolling stock was increased during the year by 80 motor cars, constructed at the company's workshops, and additional cars are now in course of construction to meet the expected increased business of the present year.

In the election of directors Messrs. F. L. Wanklyn and C. E. Porteous were replaced by Col. H. M. Pellatt and Mr. Frederic Nicholls. Mr. Pellatt is president of the Toronto Electric Light Company, and Mr. Nicholls is general manager and second vice-president of the Canadian General Electric Company. The following is the new board: William Mackenzie, President; James Ross, vice-president; Hon. George A. Cox, W. D. Matthews, James Gunn, H. M. Pellatt and Frederic Nicholls.

SHEIK'S ISLAND POWER PLANT.

The reference in our February issue to the visit of electrical engineers and other interested persons to the power plant of the St. Lawrence Power Company at Sheik's Island, near Cornwall, Ont., was somewhat misleading, inasmuch as it should have stated that the party were the guests of the Bullock Electric Manufacturing Company, of Cincinnati, Ohio, and not of Messrs. Collyer & Brock, who have no connection with the Bullock Company. The Bullock company installed the electrical apparatus and the visit was made for the purpose of witnessing its operation. Mr. A. Collyer is district manager at Montreal for the Bullock Electric Manufacturing Company.

VERDICT AS TO BOILER EXPLOSION.

A boiler explosion occurred in the pump factory of Angus McLeod at Portage la Prairie, Man., on February 15th, by which Duncan McLeod was killed. According to the evidence of the owner of the factory, there were only ten pounds of steam on an hour or so before the explosion, and scarcely any fire had been put on in the meantime. He also stated that a safety valve had not been used on the boiler and that it had not been inspected by Government Inspector. The following verdict was brought in by a jury: "That Duncan McLeod met his death by the explosion of a boiler in Angus McLeod's pump factory which explosion, we find, was caused by too great pressure of steam; that the said boiler was being run without a safety valve; that the said boiler was being run without proper Government inspection; that the said boiler was defective."

SPARKS.

A meeting was held in Cornwall, Ont., recently when Mr. M. P. Davis, proprietor of the Sheik's Island power plant, had a conference with the town council regarding the securing of new industries for Cornwall, to be operated by electric power. Mr. Davis stated that at 10 days notice he could supply 600 horse power, in a slightly longer period 1,200 h. p., and in a few months 4,000 h.p. The plant will develop 4,000 horse power, but at present it is only furnishing light to the Cornwall canal.

Attention is directed to the advertisement of Messrs. Johnson, Willats & Co., 192 King street west, Toronto, branch office, London, England, importers and exporters of Canadian and East India mica in white, rose, light and dark amber for commercial, manufacturing and electrical purposes. This firm make a specialty of stamped solid sheet mica segments, cut to any size or shape required, solid sheet mica washers and bushings, and solid mica rings for all commutators. They also handle the agency for the Dominion of Canada, for kant krack mica chimneys, for Welsbach and Auer lights. Messrs. Johnson, Willats & Co. are now in a position to furnish mica to the trade in any design, shape, pattern or form.

TELEGRAPH and TELEPHONE

THE LATE C. W. LUNDY.

Some particulars have come to hand of the life of the late C. W. Lundy, of Halifax, N. S., superintendent of the Direct United States Cable Company, whose portrait appeared in last number Mr. Lundy was an Englishman, and in the early days of electricity he decided to make electrical work his profession. His life was spent in the cable business. He saw service on three continents and was present at the laying of the Atlantic cable in 1895. The first cable across the Atlantic was laid in 1858, from Ireland to Newfoundland, but it proved a failure. Seven years later the famous steamer Great Eastern started to lay the second cable. On August 2, 1865, when about two-thirds of the distance between Valentia, Ireland, and Heart's Content, Nfld., was covered, the cable broke in 15,000 feet of water. It was, however, recovered a few weeks later, and communication was established for the first time between Europe and America.

Mr. Lundy, who was then in the employ of the great firm of Siemens, the constructors, was aboard the Great Eastern during the laying of the cable, and after its completion had the honor of receiving the first trans-Atlantic cablegram which announced the wreck of a Cunard liner. The message which is in Mr. Lundy's handwriting, and bears his signature, is preserved in the archives of the company.

At the age of twenty-two Mr. Lundy was superintendent of the Anglo-American Cable at Heart's Content, Nfld., the first cable station in the new world. Thence he was transferred to Madras, India, where he spent several years in the employ of the Eastern Company.

In 1874 the Direct United States Cable was laid across the Atlantic from Ireland to the Novia Scotia coast, the landing being made at Tor Bay, a lonely spot in Guysboro County. One year later Mr. Lundy came out as superintendent, and that important position he held continuously until his death. In 1890 the Direct Cable was continued to Halifax. The station at Tor Bay was abandoned after fifteen years' occupation, and the American headquarters were established at Halifax, which was thereby put in direct communication with the Old World. Since that date Mr. Lundy has resided in Halifax, N.S., occasionally going home to England on short furloughs.

ANNUAL MEETING BELL TELEPHONE COMPANY.

The annual meeting of the shareholders of the Bell Telephone Company was held in Montreal on February 26th, at which the statement presented was considered satisfactory. The report in part stated :

"Four thousand four hundred and ninety-eight subscribers have been added during the year, the total number of sets of instruments now earning rental being 42,858. The company now owns and operates 343 exchanges and 514 agencies. Two thousand eight hundred and forty-three miles of wire have been added to the long distance system in 1901 ; of these, 1,303 miles are in the Ontario department, and 1,540 in the eastern department. The long distance lines now owned and operated by the company comprise 24,193 miles of wire on 6,634 miles of poles.

The revenue account showed the receipts for the year to have been $1,851,535.22, and the expenses of operating $1,324,424.53, together with other expenses, making $1,433,799.41, left the net revenue $417,735.78. From this $400,000 dividends were paid to January 15, 1902, and the balance was $17,735.78. The balance of revenue from 1900, of $74,085.87 added to this made $91,821.65. Written off plant and patent account was $50,000, carried to insurance reserve $10,000, and to accident reserve $10,000, leaving to be carried forward ty 1902, $21,821.65.

Applications for the construction of long distance lines are constantly being received, such lines, particularly in sparsely settled districts, being of great value to the public ; but our expansion in that direction has been checked because of lack of capital for construction purposes. The shareholders, at a special meeting held on December 5th, 1900, authorized application to Parliament for power to increase the capital from $5,000,000 to $10,000,000, and this matter is receiving attention."

In explanation of the proposed increase in the capital stock of the company, the president, Mr. C. F. Sise, stated that the surplus revenne was not sufficiently large to meet the requirements of the increasing service which the company had had to keep up with. He mentioned that during the coming year something like one million dollars would be needed to make the extensions required. They were inaugurating a long distance service in the Northwest at present, which gave promise of being a great benefit to the people in that section as well as being of profit to the company.

The annual report was unanimously adopted, and at the close of the meeting the following directors were re-elected : Messrs. C. F. Sise, F. P. Fish, W. R. Driver, Boston, Hugh Paton, Hon. Robert Mackay, Charles Cassils, and Thomas Sherwin.

TERMINAL BUILDINGS FOR PACIFIC CABLE

The site is being cleared for the new terminal buildings for the new Pacific cable line to Australia which are to be erected on the west coast of Vancouver Island, on Barkley Sound. The site of the buildings is a beautiful peninsula where Banfield creek flows into the Sound. The property consists of about 160 acres. The approach to the landing from the sea is over an ooze bottom which will make an ideal bed for the cable.

The plans for the buildings were prepared by F.M. Rattenbury, architect, of Victoria. The main building will be 100x120 feet T shaped, one arm being devoted to the office for the cable telegraph and land telegraph suites of offices, and the other wing to the residential section. There will be separate laundry buildings and a bungalow for the manager. The buildings will be illuminated with electric light, and a water service will be provided by laying a pipe to a mountain stream several miles away.

The cable will be 7,986 miles in length, and the cost of laying it will exceed $8,900,000. The contract for laying the cable was awarded some time ago to the Telegraphic Construction & Maintenance Company, and the following is the route : Vancouver Island, B. C., to Fanning island, 3,561 miles ; Fanning island to Suva, Fiji, 2,903 miles ; Fiji to Norfolk island, 961 miles ; Norfolk Island to New Zealand, 537 miles ; Norfolk island to Queensland, 834 miles.

The manufacture of the cable has already been commenced The first expedition in connection with the laying of it is expected to leave the Thames this month. This will include the laying of the section of the cable from Queensland to Norfolk Island, Norfolk Island to New Zealand and Norfolk Island to Fiji Islands. The ship being built for the purpose will be called the Colonia. The size of the vessel may be gathered from the fact that a portion of her equipment will consist of 5,000 tons of cable, a far greater load than the Great Eastern was capable of carrying.

SHORT CIRCUITS.

The shareholders of the People's Telephone Company, Sherbrooke, Que., have approved of an issue of $25,000 preference stock.

The directors of the Windsor Hotel, Montreal, have decided to install the Bell Telephone system in 400 rooms of the hotel, and to have the instruments connected with the long distance service. A private branch exchange will be installed in the rotunda office.

The Minister of Finance laid on the table of the Dominion House last week the correspondence which had passed between the government and Mr. William Marconi regarding wireless telegraphy. Mr. Marconi makes the following proposition : The Marconi Wireless Telegraph Company is to erect two stations, one in England and the other in Nova Scotia, with the object of carrying on communications on a commercial basis between the Dominion and Europe. The Government is to agree to contribute $80,000 for the erection of a station in Nova Scotia and all messages to be sent over government telegraph line at rates not higher than those charged for ordinary commercial messages. The company agrees to transmit messages between Canada and the United Kingdom at rates which shall be fully fifty per cent. less than the rates now charged for cable messages between these countries ; in other words, a reduction from 25 cents a word to 10 cents a word, while for the Government and for press messages the rate is not to exceed 5 cents a word. The Dominion Government has accepted the above proposition which has been likewise approved by the directors of the Marconi Wireless Telegraph Company.

ENGINEERING and MECHANICS

HEAT CONTROL.

On February 15th, a lecture was delivered in the Engineers' Hall, Victoria street, Toronto, before the Toronto Association of Stationary Engineers by Professor Warren S. Johnson, of New York, president of the Johnson Electric Service Company. There was a good attendance of architects, engineers, and other interested persons. The subject announced was "Heat Control", but the speaker confined his remarks more to an explanation of the conditions under which we live than to methods of controlling heat. Five things, he said, were necessary to human life, namely, air, heat, water, food, and moisture or humidity. Brief reference was made to the component parts of air, during which he stated that the impression that carbonic acid gas is poisonous was an error.

The second element of life, Heat, was dwelt upon at some length. Prof. Johnston said that it was now admitted that heat was simply a wave. The universe is supposed to be filled with light ether, very fine in its constituent parts. These waves are of various lengths, the longest being electricity; the others in the following order: Heat, Light, Chemical-acting, Roentgen. When these waves strike us they are called Heat. Electric waves travel at a speed of 186,000 miles a second. The longest electric wave perceived is 15,000 miles: two of which would span a space between Toronto and San Francisco. Some heat waves, the speaker said, were very short. All heat passed out in straight lines, the same as light, and would also pass through glass in the same manner. An explanation was given of the Fahrenheit scale for measuring heat, it being shown that at 480 below zero there would be no heat waves.

After a few words as to water and food, Professor Johnson passed on to the fifth element of life, moisture. He stated that it was not water, but gas, and that all air contained humidity, the latter being entirely separate from the air. An attempt to live in an atmosphere devoid of humidity would bring death in short order. Moisture in air had many peculiarities. One of these was that when there was a certain quantity in the air it would take up no more. This point is known as saturation, and marks 100 on the scale of the hygrometer, so that the range of humidity is from 0 to 100 per cent. The matter of percentage of moisture depended, however, on the temperature. The warmer the air the greater amount of vapor it will require to give the same percentage of moisture, and vice versa. The average humidity of outside air is from 70 to 80 per cent.; on rainy days it would be about 100 per cent. Also it would be greater in January than in July. Supposing the humidity of the air in a room to be 80 per cent., and the outside temperature 32 degrees; if you raise the temperature 17 degrees the humidity would be only 40 per cent; then raise it 17 degrees more and the humidity would be only 20 per cent

The necessity of moisture, the speaker said, was not generally recognized, yet it was a curious fact that it is only through the moisture in the air that it retains heat. If the air has little or no moisture in it the radiated heat goes through it without warming it. If there were no moisture everything would freeze at night when there is no sun. As to the amount required in a room, if it was too great it would freeze on the window. One pound of water would humidify 4,000 cubic feet of air. In school buildings 50,000 cubic feet of air per minute, and a humidity of 40 to 45 per cent. is required. This would take two tons of coal and 500 pounds of water. The temperature of schools, residences, etc., for comfort should be about 70° Fahr; if 5 degrees less it will be chilly and if 5 degrees above, too warm.

Professor Johnson said that until twenty years ago there was no method of controlling the heat of a room except by fueling. He then began experimenting in a school building where he was professor, and, as is generally known, had since invented regulators for the control of both heat and humidity. By means of apparatus brought with him for the purpose, he demonstrated to the audience the delicate yet reliable working of his devices, which he said had been placed in several buildings in Toronto.

In reply to questions, Professor Johnson stated that hydrogen could be compressed to a liquid, and that a Marconi wave would cross the Atlantic in 03-thousanth part of a second. The fastest electric wave would pass seven times around the world in a second.

A hearty vote of thanks was tendered the speaker for his address, which was much appreciated.

STEAM PIPES.

The importance of attending to the quality and security of steam pipes is being strongly emphasized by the frequency of accidents which have happened of late to that part of an engine's equipment. Many hints regarding this matter will be found in the memorandum presented by Mr. C. E. Stromeyer to the Manchester Steam Users' Association. He has found that many of the fittings sold as cast steel are of less strength than cast iron. There will always be a doubt regarding steel castings so long as they are liable to have many blowholes which are not apparent on the surface. There are some steel works, however, which turn out fairly good steel castings of uniform soundness, so that we may infer that blowholes are not altogether inevitable. The great evil is water-hammer in pipes and valves, and this is illustrated by a case in which the plug of water struck the brass valve of a junction valve, turned it inside out, and drove it through its seat into the boiler, which at that time had a full pressure of 150lb. per square inch. The valve casing was not fractured. Horizontal lengths of pipe with an upward bend at one of the ends have proved extremely dangerous if they can become completely filled with water. If the steam be turned on to be in contact with the water in a vertical pipe, and if also the water in a horizontal length be allowed to drain out until it sinks below the inside top of this pipe, then the steam rushes into the space above the water, sweeping up waves which set the entire mass into violent motion, and causing it to oscillate backwards and forwards, until it strikes the valve and shatters it. Expansion bends are of several forms. There is (1) the inverted $\cap$, consisting of a semicircle and two straight pieces, each joined to a short quarter-bend; (2) the semicircle joined to two quarter-bends of the same radius as itself; (3) the bend consisting of one piece of two-thirds of a circle, and two pieces of about one-third each; (4) the complete circle; (5) the complete circle set at right angles to the axis of the steam pipe, and stressed in torsion. If the permissible springing of No. 1 be represented by 2 2-3rds, then that of Nos. 2, 3 and 4 would be 12, and that of No. 5 would be 21. The permissible amount of stretching of any of these bends is directly proportional to the mean height of the loop, and inversely proportional to the square of the diameter of the pipe, and independent of the thickness of the metal, but the force required to effect the stretching is proportional to the thickness of the metal and to the square of the diameter of the pipe. If, therefore, a weak flange has to be relieved, the bend should be of the thinnest possible metal. Mr. Stromeyer prefers steel bends to copper ones, because having a higher elastic limit, they give a greater range of motion. If the pipes are arranged to be short, when cold, by half the designed range of the bend, then the value of this bend is practically doubled, and if the straight line of pipes can deflect sideways, the range is again doubled. A 4-ft copper bend is, under these circumstances, capable of relieving an expansion amounting to 1-6 inch.

ENGINEERS' AT-HOME.

The annual At-Home of Toronto No. 1, C.A.S.E. was held in St. George's Hall, Elm street, on February 24th. During the evening a musical programme was rendered by Mrs. Coutts-Bain, Mrs. Sears, Miss Coutts, Miss Froud and Messrs. Chas. Ellis, H. Gillogley, and W. G. Blackgrove. Dancing was kept up till an early hour to the strains of Prof. Hardy's orchestra. The At-Home committee comprised W. G. Blackgrove, chairman; James Bannon, secretary; H. E. Terry, N. V. Kulham, E. J. Philip, W. H. Johnston, J. W. Marr, R. J. Johnston, Alex. Stoner, and W. J. Webb, president of the association.

Mr. Charles O. Card purposes building a flour mill at Cardeston, N.W.T., in which he will install an electric light plant.

WILLIAM HAMILTON.

Death has removed one of the prominent citizens of Peterborough, Ont., in the person of Mr. William Hamilton, the founder and for so many years the head of the William Hamilton Manufacturing Company, of that city. Ten years ago Mr. Hamilton was stricken with paralysis, and since that time was an invalid.

Mr. Hamilton was a Scotchman and was in his 79th year. In 1844 he came to Canada and worked as a machinist in Hamilton and Cobourg. Then he went to the United States and in 1850 established a foundry at Shelbyville, Ind. Leaving there in 1856, he went to Peterborough and established the works which have since grown to the large establishment conducted by the William Hamilton Manufacturing Company. By energy and business talent the business was made to grow and develop. At the present time it is one of the most progressive establishments in the manufacture of mining and mill machinery, water wheels, etc., the products of the works being in use in mills and factories from the Atlantic to the Pacific coast.

The late Mr. Hamilton, although often consulted, never sought any public position, but always took an active interest in the affairs of his town and country. He was a man of integrity, energy and preseverance, and gave close attention to the interests of the industry of which he was the head. He was most highly respected by his employees, as well as by all who knew him. Mrs. Hamilton, five daughters and one son survive, the latter being Mr. William Hamilton, president and general manager of the company.

TRADE NOTES.

The Goldie & McCulloch Company, of Galt, Ont., advise us that they are now putting the word "Canada," as well as "Ont.," on all their machines. That is to emphasize the fact that Canadian users of machinery do not need to import machines, and that Canada certainly has a place in the manufacturing world.

At a recent meeting of the directors of the Robb Engineering Company, Amherst, N. S., it was decided to issue a balance of $70,000 of debentures and $30,000 of stock held in the treasury. During the past year the company's sales increased considerably, and orders are now on hand to keep the works busy for the next six months, so that a further increase in the capacity of the plant seems necessary. Mr. John F. Stairs, president of the Nova Scotia Steel & Iron Company, and Mr. Grant, director of the Nova Scotia Building Society, were appointed to the directorate.

The Burridge Company, Winnipeg, agents for The Goldie & McCulloch Company, Galt, have recently sold a 100 horse power Wheeleck engine, two 75 horse power boilers, with shafting, pulleys and hangers, to The Brandon Binder Twine Company, of Brandon, also an 8 x 10 Ideal engine to the Winnipeg General Hospital, which makes two of their Ideal engines now in use in this hospital. They have recently installed a 10 x 10 Ideal engine for the North-West Laundry Company, of Winnipeg, and have also wood-working machinery in transit for delivery. The Burridge Company has recently established themselves in Winnipeg, doing business principally for The Goldie & McCulloch Company, of Galt, and the Kerr Engine Works Company, Walkerville, Ont., manufacturers of steam and hydraulic valves.

When the fire occurred at the Royal Electric Station in Montreal and destroyed the wide double leather belts, it was thought that there would be much delay in obtaining new ones, but such was not the case for the reason that the enterprising firm of Sadler & Haworth had men upon the ground before the fire was out, removing the damaged belts to their factory to repair as best they could, so that they could be used the same night. It was discovered, however, that the large 54-inch, 3-ply belts, which were made by the same firm about 12 years ago, could only be repaired temporarily, and under the circumstances an order was given to Sadler & Haworth for new wide belts, including a number of smaller sizes, upon condition that they would be all ready within three days. To the surprise, relief and pleasure, however, of the manager of the Royal Electric Co., all the belts, including the large ones, were in position and ready to run, in 48 hours after order had been given, which goes to show that the firm of Sadler & Haworth have unusual facilities for handling large contracts in a short space of time. Had this not been the case, the city of Montreal would have been obliged to have resorted to some other method of obtaining light than from electric power.

MOONLIGHT SCHEDULE FOR APRIL.

Day of Month.	Light.		Extinguish		No. of Hours
		H.M.		H.M.	H.M.
1....	P.M	7.00	P.M.	3.30	8 30
2....	"	7.00	"	4 00	9 00
3....	"	7.00	"	4.30	9 30
4....	"	7.00	"	5.00	10. 00
5....	"	7.00	"	5.00	10.00
6....	"	7.00	"	5.00	10.00
7....	"	7.00	"	5.00	10.00
8....	"	7.00	"	5.00	10.00
9....	"	7.00	"	1 45	9.45
10....	"	7.00	"	1.45	9 45
11....	"	7.00	"	1.45	9.45
12....	"	7.00	"	1.45	9.45
13....	"	10.30	"	1.45	9 15
14....	"	11.30	"	4.30	5.00
15....	"	0.15	"	4.30	4.15
17....	"	1.00	"	4.30	3.30
18....	"	1.30	"	4.30	3.00
19....	"	2.00	"	4.30	2.30
20....	"	2.30	"	4.30	2.00
21....	No Light.		No Light.		
22....	"		"		
23	A.M.	7.20	A.M.	9.20	2.00
24....	"	7.20	"	10.20	3.00
25....	"	7.20	"	11.00	3.40
26....	"	7.20	"	0.00	4.40
27....	"	7.30	"	0.40	5.10
28....	"	7.30	"	1.20	5.50
29....	"	7 30	"	2 00	6.30
30....		7.30		2 30	7.00
			Total.....		180.20

FOR SALE.

1 25 light Reliance Arc Dynamo in first-class condition.
1 60-light Royal Type Transformer, 1040 volts to be newly re-wound.
3 10-light Shellenberger Watt Meters.
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PUBLICATIONS.

The second edition of Wiener's "Practical Calculation of Dynamo Electric Machines" has been issued by the Electrical World and Engineer, 120 Liberty street, New York The book contains 750 pages, 390 illastrations, and 125 tables, and sells for $3.00. The dynamo calculations contained therein are based upon the practical data aud tests of over two hundred of the best modern dynamos. Differing from the usual text-book methods, the present treatise gives practical information in the form of original tables and formulas derived from the results of practical machines of American as well as European make. Among new matter added to the second edition are sections of the calculation of multipolar, multiple circuit, and double-armature dynamos; the calculation of dynamotors and double-armature motors; dynamo specifications; and wire-winding data and remedies for sparking.

The Pittsburgh Transformer Company, of Pittsburgh, Pa., issue a number of publications which will be found of very general interest. A characteristic feature of these is found in the fact that the type K transformer (made by this compauy) is treated of in a detailed manner and illustrated in a way that is, unfortunately, rare amongst advertising literature. In catalogue C will be found complete descriptions of this company's product. The half-tone engravings bring out the design and construction of the transformer exceedingly clearly. Bulletin No. 1 summarizes much of the matter contained in catalogue C. Bulletin No. 4 is devoted to the use of oil in transformers, and gives the results of tests showing the effect of oil both on the cooling of the transformer as well as upon the breakdown strength of insulating materials. The three-wire system of secondary distribution is treated of in Bulletin No. 7, and in view of the increasing use of this system, the information regarding three-wire transformers contained therein should prove of interest. Bulletin No. 8, the latest publication of the company, points out the importance of durability in transformers. The point made is that a transformer of the highest electrical efficiency is not truly efficient unless its construction and design is such that expenses from burn-out is reduced to a minimum. The product of this company appears to be as well liked and familiar to the trade in Canada as in the United States, which is doubtless due not only to its merits, but also to the care which has been bestowed upon the printed matter devoted to its description.

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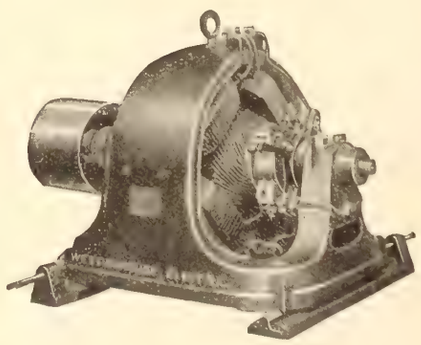
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Wri e Ahearn & Soper, Limited, OTTAWA, Canada.

SPARKS.

Hydraulic experts are now making surveys at Coquitlam Lake, B.C., in connection with the water power development to be undertaken there by the Vancouver Power Company.

The Levis County Railway Company is asking for incorporation, to construct a system of steam or electric railways in the county of Levis, Que. The applicants include Alfred Conyer, Montreal; William J. Remick and R. D. Wycoff, bankers, New York; Jos Paquette, Levis; and G. H. U. Holman, Quebec.

Messrs. W. H. Robert, of Beauharnois, E. B. Greenshields, E. C. D. Featherstonhaugh and C. J. Flett, of Montreal, are seeking incorporation as a joint stock company to develop and distribute electric light and power in Beauharnois, Que. The Sorel Electric Company is seeking incorporation to operate an electric railway through the counties of Vercheres, Richelieu and Yamaska, Que.

The Canadian Hand Book of Steam and Electricity should be in the hands of every central station man. Sent to any address on receipt of only 50 cents. Address The C. H. Mortimer Publishing Co., of Toronto, Limited, Toronto, Canada.

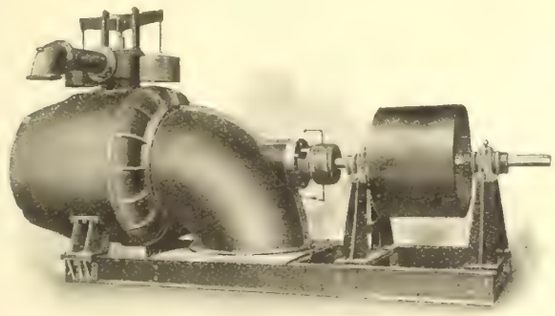
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THE GOULD STORAGE BATTERY.

By W. Gee.

Storage batteries in Canada are looked at with suspicion. Inexperience and unfamiliarity with storage batteries has a great deal to do with this, but still storage batteries have become such a necessary adjunct to central electric light and power stations that managers no longer dispute their usefulness. It behooves them, therefore, to examine carefully the mechanical points of batteries and to inform themselves fully as to the electrical and chemical characteristics of different forms of battery plates.

With this object in view I desire to explain the points of our product in such a way as will make clear the present tendencies of storage batteries, as they are all toward the sub-division of the support plate and consequent increase of active material contact surface. To accomplish this, grooving and sawing the surface of the plates have been resorted to, and in Germany casting under pressure, so as in each case to produce on the face of plate ribs and spaces between them for the active agents, paroxide of lead on the positive and finely divided lead on the negative. All of these methods produce plates which are either structurally weak or provide spaces of too great cross section for the economical utilization of the active material. Cast lead is so much less in its construction than rolled lead that the disintegration is much less rapid when that method is resorted to.

The ideal battery might be described as one composed of thin sheets of lead placed vertically in a recepticle, the spaces between being slight and the coating of active material on the surface very thin. With this method mechanical difficulties are encountered, and the adherence of the active material to the support plate is most unstable.

The Gould battery fills all the conditions of the ideal battery. The vertical plates are represented by thin ribs from .012 to .020 of an inch in thickness, depending on the work to be done, at right angles to the surface holding the active material securely between them. For the same weight of lead and the same volume of space occupied, the Gould plate has 60 per cent. more actual active material contact surface than the so-called ideal battery; though these ribs are produced by spinning as shown in cut, a process which may be described as the displacement of sheet lead by revolving discs of steel held against the surface, the lead not being grooved or cut, but simply pushed up between the discs. The plates are spun up in section, their size depending upon the total superficial area of the plate. The circular disc entering at each end at an angle leaves the rib, anchored as it were, at either end at an half diamond (D) of solid lead and with a very small centre line (A) as indicated. At the junction of two sections the two half diamonds together form section of solid lead running across the plate and at the same time the unspun portions are retained between the sections vertically.

The spinning process produces a plate with from 10 to 20 square inches of active surface contact per square inch of superficial area, and from 200 to 400 square inches per pound of plate. It also renders the molecular structure and density of the ribs absolutely uniform throughout, and at the same time maintains the characteristic relation of the ribs and supporting frame, the whole being one integral piece of lead, which has great advantage over a plate built up of separate parts. Chemically pure rolled lead is used, thus doing away with the local action between the lead-antimony, which is inherent in plates made with lead-antimony supports. This latter type often shows a difference of potential on a negative of .225 volts when charged, between the spongy lead and the lead antimony supports, whereas the difference between spongy lead and pure lead under the same conditions is only .055 volts. The evolution of gas during charging, which causes in many instances such inconvenience, is greater when the support is antimonious-lead than when pure lead is used, and under normal conditions is remarkably slight in the Gould battery owing to some extent to the absence of persulphuric acid, thus indicating the presence of a large formation of lead sulphate during discharge, the utilization of the total volume of peroxide and its perosity. The life of the plates depends on the thickness of the ribs, so that by the slightest alteration, the relative amount of deterioration can be changed to suit local conditions. At the same time that the life is decreased by lessening the thickness of the ribs, with the same weight of lead, the surface is increased, thus augmenting the capacity and at the same time the discharge rate.

In the Gould battery no metallic lead is exposed to the electrolyte, the entire surface being covered by a layer of peroxide of lead. In the stationary batteries the spaces allowed for the positive material are .012 of an inch in width, with a thickness of only .006 on the surface of the ribs. This small volume is almost completely reduced to sulphate of lead in discharging, and no unaltered peroxide remains to become superoxidized and soft, which, after some usage, would shed off and drop to the bottom of the containing jar, thus reducing the capacity.

The action of the current starting at the metallic lead can only proceed to a certain distance depending on the discharge rate per unit of area. The thickness of active material on the surface of the ribs and width of the ribs are the results of careful calculations and of long experimental work, and combine the greatest capacity compatable with the longest life. This has been proven by the fact that these plates as time goes on become thinner, the ribs on their outer edges wearing away at the same rate at which the active peroxide is shedded. This is truly an ideal condition and one which is not to be found in other types. The large active area has the greatly to be desired effect of reducing both polarization and internal resistance. It also increases the efficiency by maintaining high electromotive force during discharge, necessitating a lower end voltage in recharging. While it has been maintained by experts in this country and Germany that a good electro-chemical negative was the more difficult of the two plates to produce, the Gould Company have been able to construct a negative which is equally as good as the positive and which has many excellent features, among which may be mentioned low internal resistance, high capacity per pound and retention of capacity after years of work. Cadium reading with a Gould negative plate indicating its individual potential show a remarkably slight increase between the two extremes of the discharge.

In storage batteries the potential of the negative plate increases and of the positive plate decreases during discharge, giving a resultant lower difference of potential between the two as discharge proceeds. In fact, the Gould negative is far in advance of what was considered possible by most expert foreign electrochemists. The limitation of capacity in the Gould battery is not that of the negative plate but that of the positive, quite the reverse of the theory and practice adopted in other well-known types. The weight of active material per ampere hour is far less in the Gould plate than has ever been obtained, owing to the fact of its being distributed over a large surface of conductor in a very thin layer. When one remembers that theoritically only .127 ounce of active material on both plates is required per ampere hour at normal discharge rates, and that .500 ounce has been necessary on the best type heretofore produced, the possibilities for improvement are most marked. The electro-chemical formation of the Gould plate is of the highest order, the result of years of careful investigations and of thousands of exhaustive experiments, producing adherent layer of active material and yet one which is very porous, allowing a free circulation of the electrolyte and the ready evolution of gas. The mechanical strength of the plate is greatly increased by spinning, forming as it were a bridge construction. The temperature at which the battery is kept plays a most important part in the life and capacity of the battery, the formation of the active sulphate being greatly accelerated by an increase in the temperature. The loss of capacity is greater as the temperature is lowered, in some cases amounting to as much as 1 per cent. in ampere hours per degree Fahrenheit.

By a careful perusal of the above facts station managers, although not storage battery experts, will be able to appreciate the points here indicated in favor of the Gould battery. The electro-chemically formed plate is now the only one which is considered where heavy work is to be done and where deterioration must be reduced to a minimum, and an examination of the work being done in this country and abroad shows a very decided tendency to this form with the subdivision and the increase o contact service.

I have had some 18 years experience in storage batteries, having erected them in several parts of the world, and have seen the difficulty under which a great many batteries have had to work, but my experience is that storage batteries can be used very profitably for residence lighting or for any reserved power, giving the most steady light without any trouble. I have a project in view and am working on an apparatus which I will soon be able to place on the market where an ordinary wind mill can be used for charging batteries.

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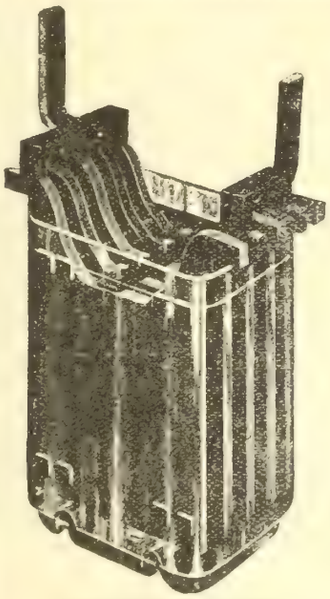
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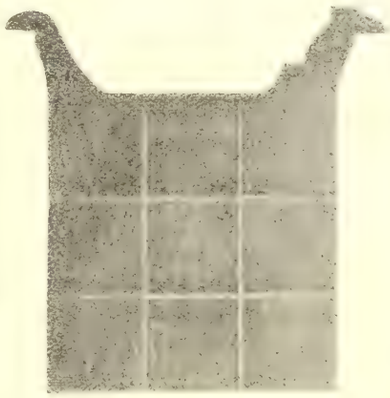
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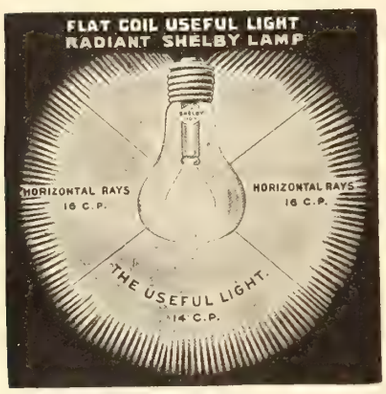
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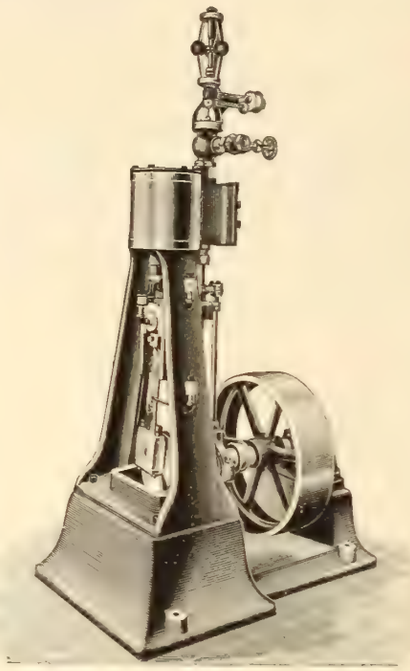


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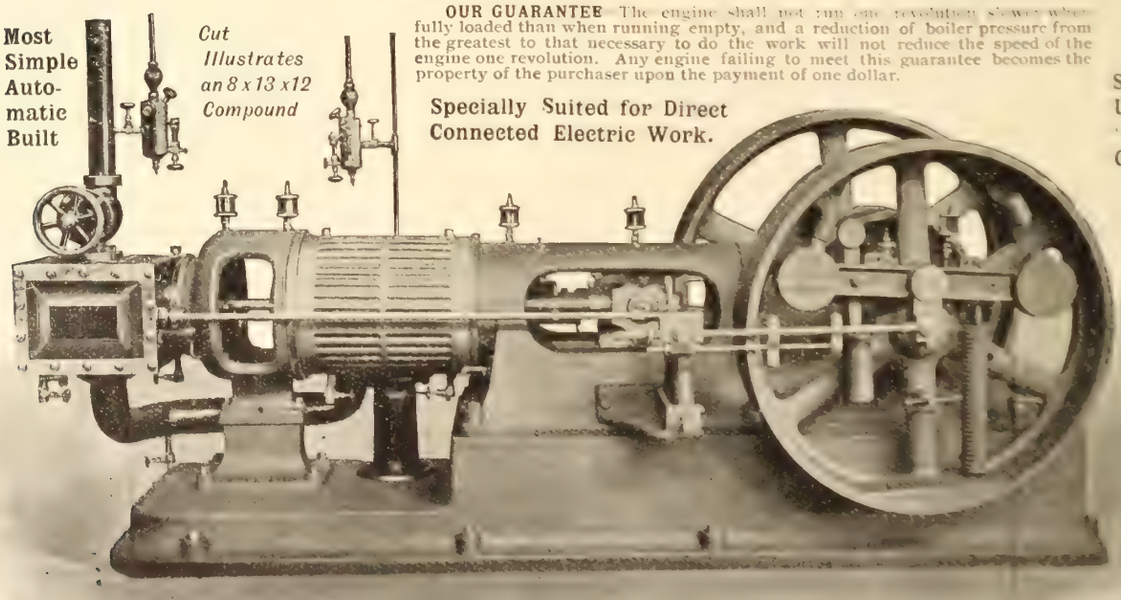
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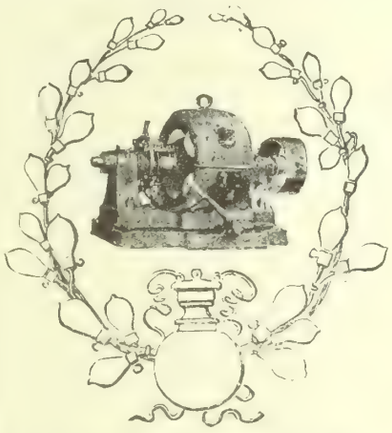
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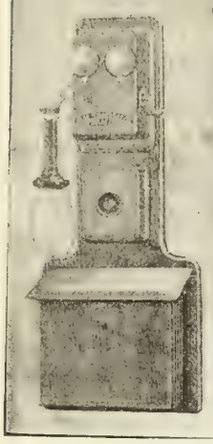
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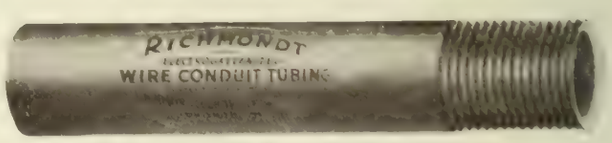
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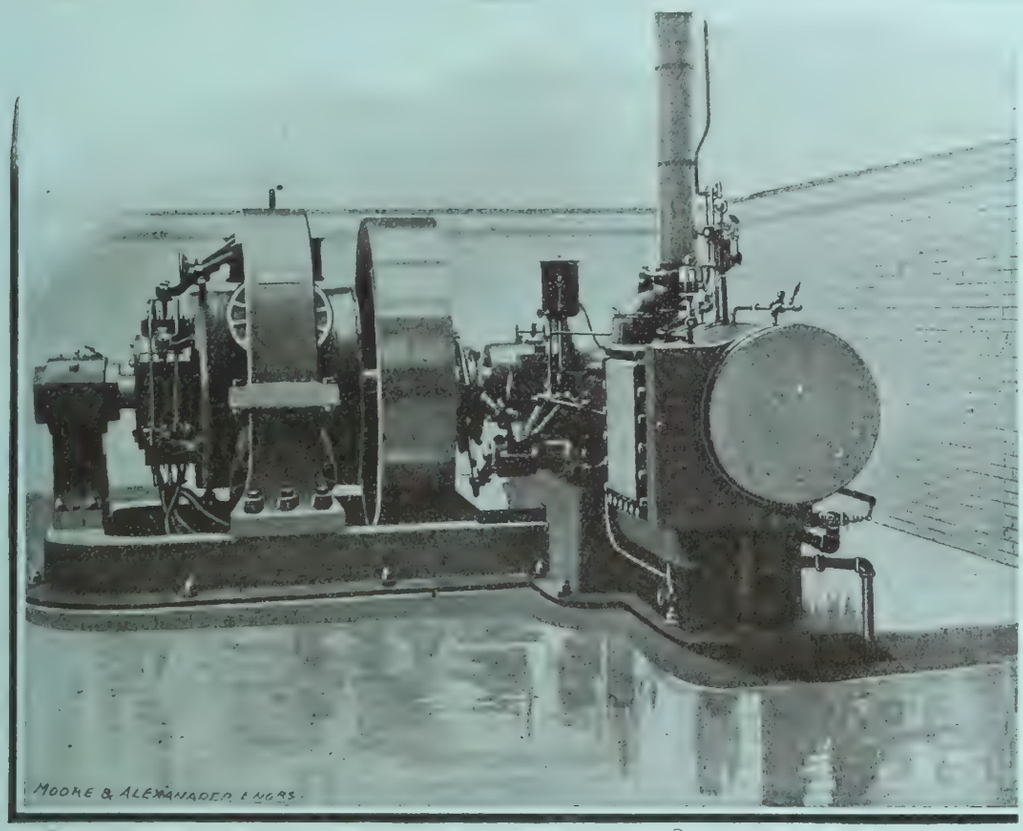
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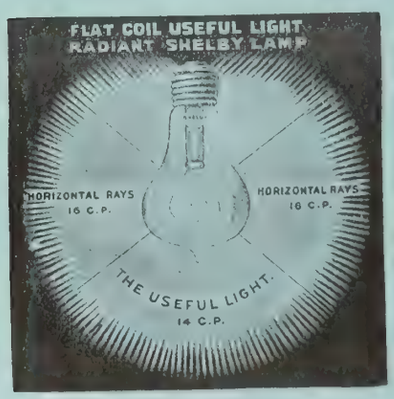
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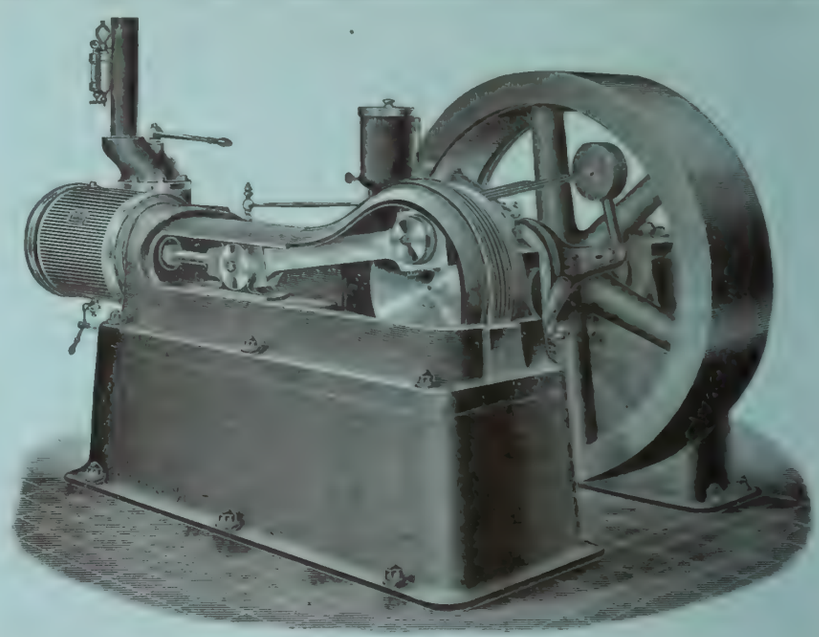
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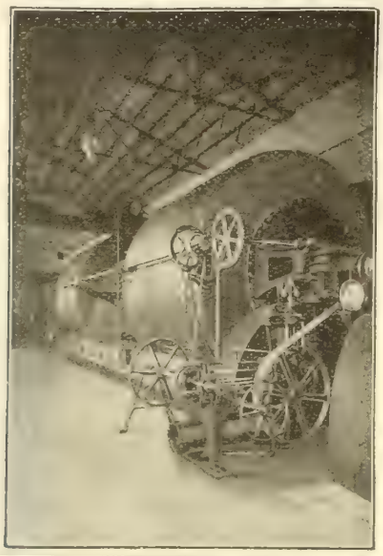
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WRITE FOR CATALOG. DEPARTMENT E.

PERSONAL.

Mr. J. E. Davis, superintendent of the Metropolitan Street Railway, North Toronto, has recently become a benedict.

The death occurred last month, from pneumonia, of Mr. M. M. Thompson, manager of the Trenton Electric & Water Power Company, of Trenton, Ont.

Mr. Robert Hill, formerly with the Hamilton Electric Railway Company, has been appointed manager of the electric road extending from Ingersoll to Woodstock, Ont.

Mr. J. A. McCrossan has resigned his position as manager of the Citizens Electric Light Company, of Rat Portage, Ont., to engage in another branch of business in British Columbia.

Mr. James Molland, who has been connected with the Electrical Construction Company in London, Ont., has purchased an interest in Seaforth Electric Light Company and accepted the management thereof.

Mr. William MacKenzie, president of the Toronto Railway Company, and Mr. H. G. Nicholls, eldest son of Mr. Frederic Nicholls, have been elected directors of the Canadian General Electric Company.

Mr. J. H. Bannon has been appointed chief engineer and Mr. H. E. Terry assistant engineer for the Toronto municipal building. Before leaving his former position Mr. Terry was presented by the employees of Mr. R. G. McLean's printing establishment with a gold watch as an expression of their good wishes.

Mr. D. A. Starr, of Montreal, who is well known to the electrical fraternity in Canada, has accepted a position with the British Westinghouse Electric & Manufacturing Company, of England. The company has a large manufacturing establishment in Manchester, and its head office in London. It is understood that Mr. Starr will have charge of the company's sales department and will be located in London.

It is probable that the ratepayers of Edmonton, N.W.T., will vote on a by-law to raise $140,000 for the installation of water works and sewerage systems and the purchase of the electric light plant from the present company.

SPARKS.

The directors of the Halifax Tramway Company propose to issue 1,000 shares of new common stock to pay for improvements in the company's lighting plant.

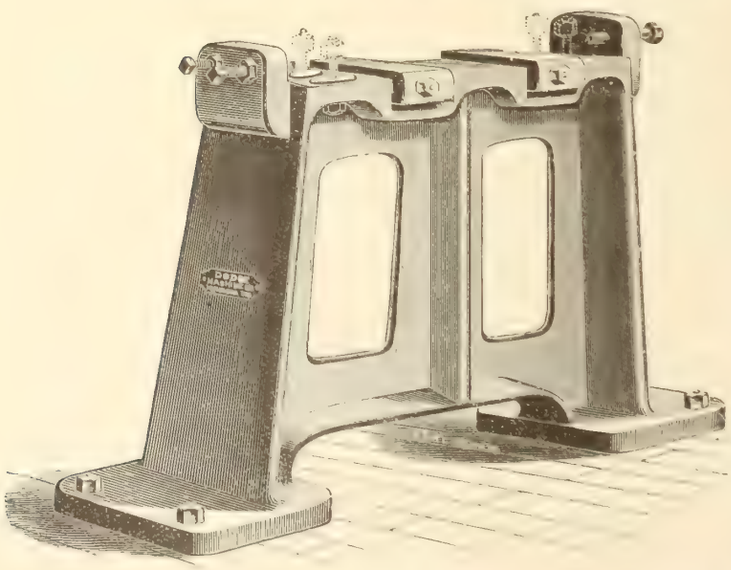
The Engineering Society of the School of Practical Science have elected D. Sinclair president, E. A. James vice-president, D. H. Pinkney corresponding secretary, and T. C. Irving recording secretary.

Mr. J. W. Burke, of Wall street, New York, and owner of the electric railway at Sherbrooke, Que., is interesting himself in the proposed electric road from Windsor to Kingsville and Leamington, of which Mr. A. J. Nelles, of Hamilton, is the promoter. The road would pass through a well-settled country and touch a number of thriving towns and villages.

A memorandum prepared by Mr. J. W. Langmuir, Chairman of the Commissioners for the Queen Victoria Niagara Falls Park, shows the following details of the work done and contracted for in connection with the power development of the Canadian Niagara Power Company at Niagara Falls: Conduit, cable and electrical machinery for use during construction, purchased and installed at a cost of $20,664: wheelpit excavation, $19,150; tunnel and shaft, $513,000; cofferdam, materials purchased, $29,000; contract for cofferdam, (now almost complete), $23,000; wheelpit and intake canal, $500,000; bridge across canal opening, to be made of masonry instead of steel, to preserve æsthetic charm of park, $55,000; transformers; generators, exciting machinery and switchboards—contract let to Canadian General Electric Company for nine transformers for proposed transmission to Toronto and elsewhere, $43,200; contract let also to Canadian General Electric Company for three 10,000 e. h.p. generators, $209,475; contract authorized for exciting machinery, $16,000; contract also authorized for switchboard, $75,000; turbines, contracts made for plans of 10,000 h.p. turbines, $10,000; upon receipt of these plans the company is authorized to order three 10,000 h.p. turbines, at a cost of $130,000; lands purchased adjacent to park, and laid out for manufacturing sites and an industrial village, $75,000. These make a total of $1,710,489.

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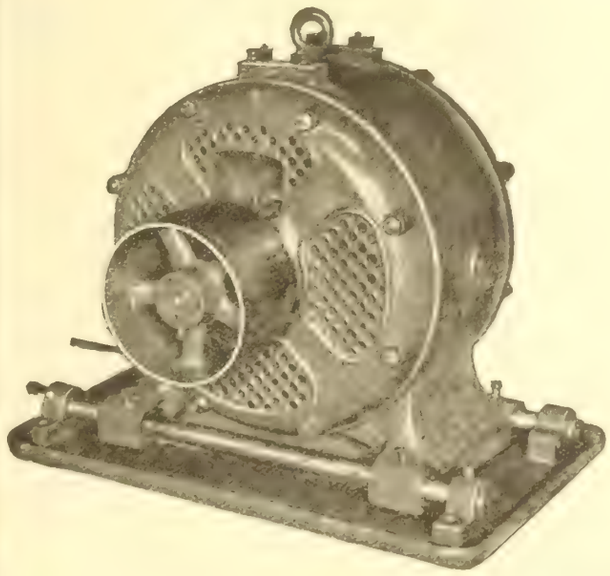
The iron used in type "L" Transformers is imported from England, is of the best grade obtainable and of a far better quality than can be obtained in the United States. There is absolutely no "ageing" of this superior iron and by its use in type "L" there is probably less energy lost in hysteresis than in any other transformer made. With this low core loss and close regulation a very high efficiency is attained on both full, fractional and all day load. Every type "L" transformer is tested on full load for three days and tested between primary and secondary coils, and between coils and iron on an alternating current of 10,000 volts.

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BRANCH: ST. JOHN, N. B.

Full Stock of Electrical Supplies. Prompt Shipments.

SPARKS.

The Canadian General Electric Company has been authorized to increase its capital stock to $3,000,000.

The Colchester Electric Lighting Company has been formed at Truro, N. S., to engage in the electric lighting business at that place. It is proposed to establish a modern plant to cost about $80,000, and to lay underground wires through the centre of the town. Power will also be furnished for manufacturing purposes.

The Canadian Pacific Railway has just installed in the Windsor street station, Montreal, seven improved electric clocks. Mr. R. J. Scott, who is chief inspector of time service for the C. P.R., claims that the electric system he has elaborated isthe best on the continent. He has upwards of 1,600 clocks under his control in the operating department alone, and only allows ten seconds variation from St. John to Vancouver

Mr. A. Bowen, who recently purchased the water power at Andrewsville, intends to install an electric plant which will furnish power to operate flour mills at Kemptville and light the village. Andrewsville is fifteen miles from Kemptville, and it is said that Mr. Bowen hopes to furnish light and power to the farmers along the route of the transmission line.

The city engineer of Toronto has reported that it would cost $22,700 to install an electric light plant on the island to supply 150 arc lights, and $30,250 if 1,500 incandescent lights were upplied in addition.

The Shawinigan Falls Terminal Railway Company is seeking a Quebec charter' to construct a steam or electric railway in the village of Shawinigan Falls and the counties of St. Maurice and Champlain. The capital stock is to be $200,000. The promoters include Messrs. Vivian Burrill, of Shawinigan Falls, and W. C. Johnson and R. W. Douglas, of Montreal.

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TRADE NOTES.

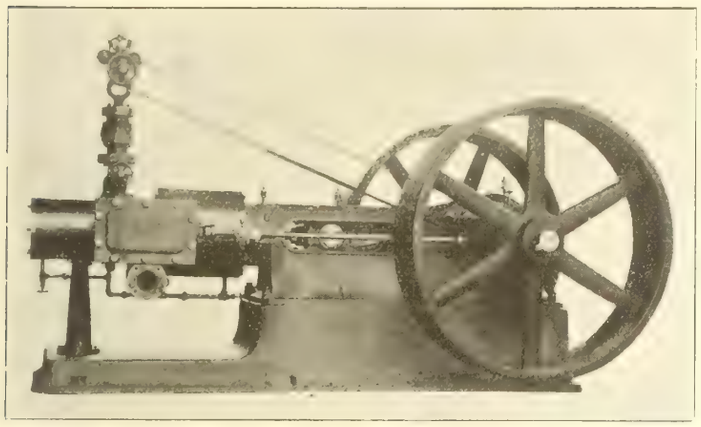
The transformers for the Sheik's Island power plant, of which a description appeared in our last issue, were supplied by the Packard Electric Company, Limited, of St. Catharines, Ont.

The annual meeting of the Robb Engineering Company, Limited, was held at Amherst, N. S., on March 18th, when Mr. D. W. Robb was elected president. The report of the directors showed that the past year had been the most successful in the history of the enterprise. The output was about $250,000, and a large amount of orders have been booked for the present year.

The R. E. T. Pringle Company, Limited, of Montreal, have recently sent their customers a pamphlet emphasizing the fact that they are in the market with an alternating induction motor equal to anything manufactured at this time. These motors are manufactured by the Ampere Electric Manufacturing Company, for whom the R. E. T. Pringle Company are general sales agents. Among the companies which have installed their motors are the Dominion Cotton Mills Company and Dominion Oil Cloth Company, Montreal; Jacques Cartier Water Power Company, Canadian Electric Light Company and Quebec Railway, Light & Power Company, Quebec; Cataract Power Company, Hamilton, and others.

Surveys are being made for the extension of the St. Thomas Street Railway to Port Stanley.

It is stated that work is to be commenced immediately on the power development to be undertaken by the Vancouver Power Company. It is expected that the project will be completed in two years, and that 20,000 horse power will be available. A two mile tunnel connecting two lakes will be built.



Economy,
Durability, Simplicity, Small Cost.
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The Hardill Compound Engine

Medium Speed

Simplified Valves

Universal Application

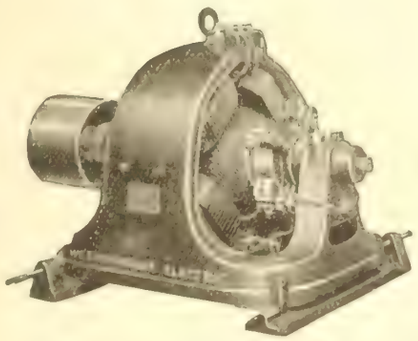
Perfect Design

Built in all cases by

THE HARDILL COMPOUND ENGINE CO.,
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The Performance of the

Westinghouse Multipolar Motor



is eminently satisfactory—the motor is built to run day and night with no further attention than an occasional filling of its self-aligning, self-oiling bearings.

In most motors the weakest point is the commutator, which wears down unevenly, gets rough, or because it possesses no fixed commutation point, sparks badly; or again, lacking a generous proportion, is apt to run hot.

The Westinghouse Motor is free from these troublesome defects.

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and Mfg. Co., Pittsburg, Pa.

Write **Ahearn & Soper, Limited,** Ottawa, Canada.

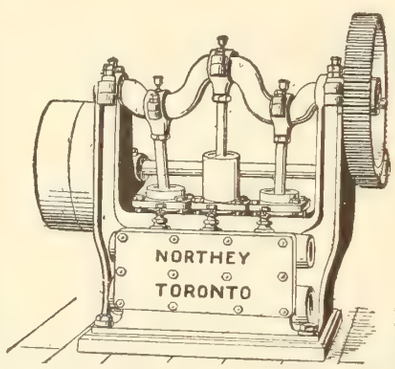
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THE NORTHEY TRIPLEX POWER PUMP



This pump excels in high class materials and workmanship. A practically constant delivery is assured by the three cranks being placed 120 degrees apart. The pump can be operated conveniently by water power—by belt from engine or by electricity.

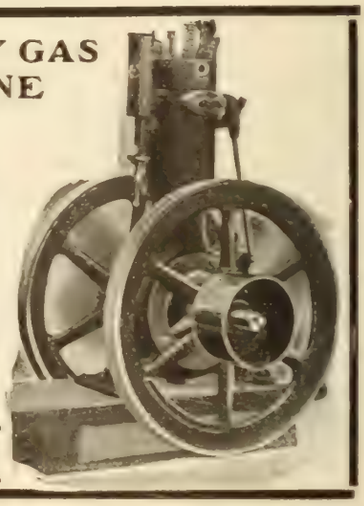
We manufacture pumps of every description—for all purposes. Our pumps are standard in Canada for excellent service.

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The NORTHEY GAS AND GASOLINE ENGINE

The Northey Gasoline Engine offers the best proposition in the market for cheap, easily handled power. The E gie runs with practically no attention—any boy can manage it—running expenses very light. Ready for work on the minute. Suitable for running independent electric light plants—pumping and elevator plants, etc. This cut illustrates the ½ H.P. size—the only vertical style built, all other sizes are horizontal.

Write r ooklet.



THE NORTHEY CO., LIMITED. 970 King Street Subway TORONTO.

NEW GUTMANN WATT METER

FOR ALTERNATING CURRENTS

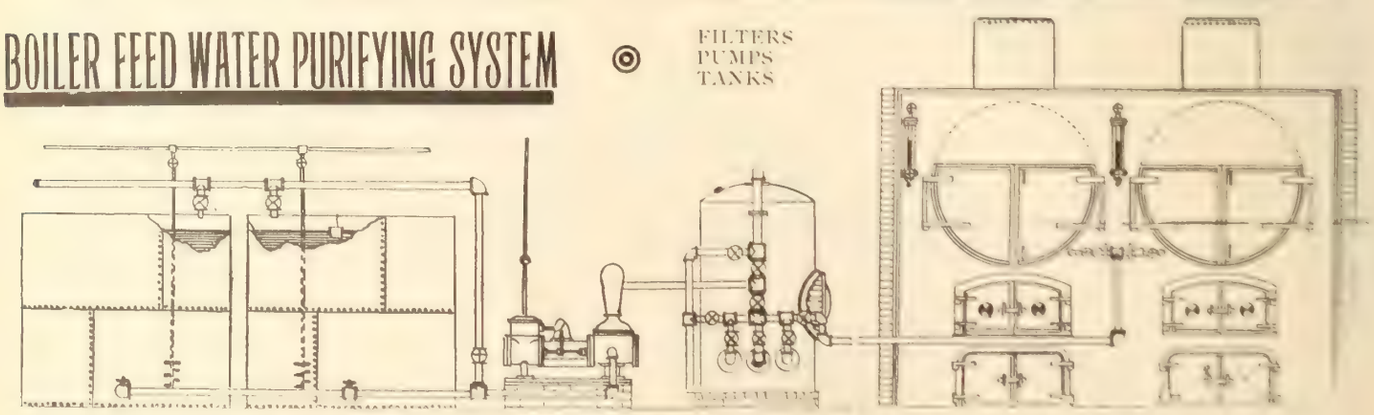
IN SHORT

The New Meter is of the sealed type.
Is correct on all loads from two per cent. of its capacity to fifty per cent overload.
Internal losses are practically nothing.
Accuracy maintained.
Simplicity in design.
Firmly constructed.
Dust, insect, moisture and water proof.
Extremely light weight (10 lbs.)
Pleasing in appearance.
Reads directly in watt hours.
Easily installed.
No complicated parts.
No friction.

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CANADIAN
ELECTRICAL NEWS
AND
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VOL. XII. APRIL, 1902 No. 4.

THE NEW ELECTRIC LIGHT PLANT AT ALLISTON.

One of the finest and most complete plants of its size in Ontario is the new one of the Alliston Electric Light Company, which was completed last September.

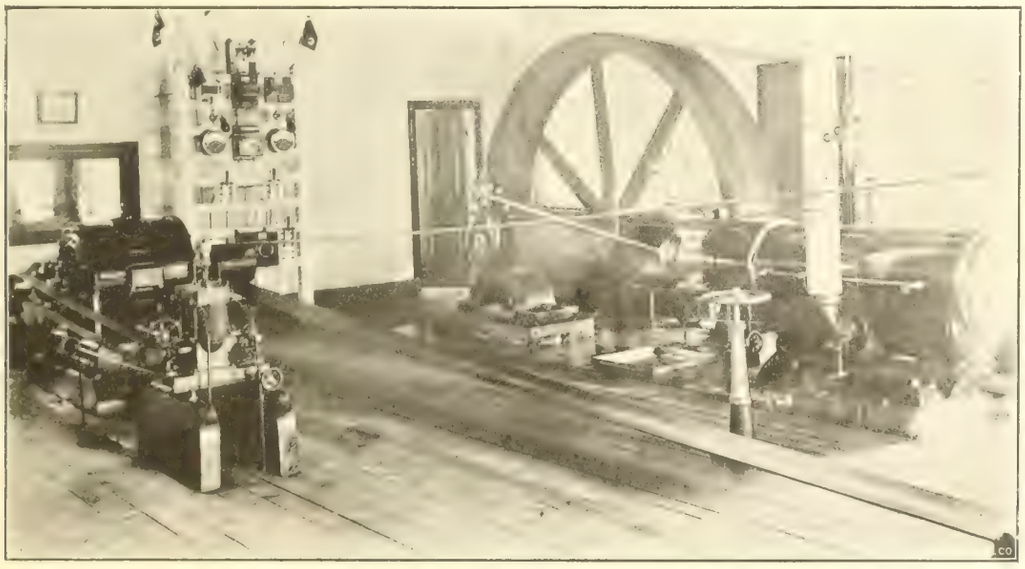
Early in the spring of 1901 it was decided that some radical changes were necessary for the proper continuance of business, for the following reasons:

First, the steam plant was over-loaded, and being of an old type, expensive to operate. Second, the building was badly in need of repairs. Third, there was no capacity for handling any extension of the system. Therefore an entirely new building was erected, and, with the exception of the electrical apparatus, which was comparatively new, was equipped with new and modern machinery.

The power house is a brick and stone structure 42 x 48 feet and situated about fifty yards immediately north of the old building. It was considered advisable to erect a new building, owing to the fact that the new machinery would necessitate extensive alterations to the old building, at a large expense, and even then it was not likely to be satisfactory. Again, in the new situation a much better rate of insurance is obtainable, also increased facilities for the development of a certain amount of water power, and ample yard room near by for the storing of the wood, which formerly had to be piled some distance from the plant.

The new building is laid out in a manner somewhat different from the average plant of this size, containing as it does an office for the superintendent 8 x 11 feet, a bed-room for the engineer 8 x 9 feet, a fire-proof oil and store-room 7 x 12 feet, beside the engine-room 27 x 38 feet, and the boiler-room 12½ x 40 feet. In the engine-room the allotment of floor space has been exceptionally liberal, and as a result the engineer has easy access to any bearing or any part of the machinery with perfect safety to himself, a feature which is often overlooked in many plants.

The steam plant was manufactured and installed by the Goldie & McCulloch Company, of Galt, and consists of one of their Wheelock engines, return tubular boiler, counter-shaft with complete equipment, belted jet condenser and duplex steam pump. The engine is of their latest type and is single cylinder condensing 14 x 34 inches, with fly wheel 11 feet 6 inches in diameter and 20 inch face. At 90 r. p. m. and using low pressure it is rated to give 125 h. p., but up to the present there has been no demand exceeding 100. It is expected, however, that in the near future considerably more than this will be required.



ALLISTON ELECTRIC LIGHT PLANT. VIEW OF ENGINE.

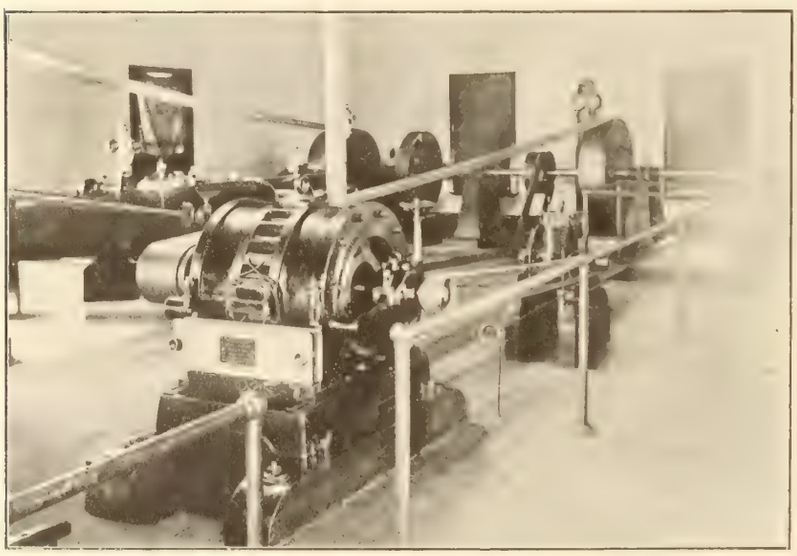
The counter-shaft is in three sections, of which two only are erected. It is mounted on iron stands of substantial and neat design, with self-oiling bearings. The first section is belted to the engine fly-wheel with a double ply endless leather belt, 18 inches wide, over a 42 inch drive. Immediately in front of this pulley is an adjustable tightener to give the belt sufficient contact and also take up any unnecessary slack. The second section contains the drive pulleys for the condenser and for the alternator, the latter pulley being 49 inches in diameter. These two sections are connected by a 27

inch Wilkinson clutch coupling. The third section, which will be belted to the water-wheel, will also be connected to the second by a similar coupling when the water-wheel is installed. This will likely be the coming summer.

The water power is obtained from a dam on the Boyne river, which runs through the town of Alliston. An average head of about 16 feet is thus obtained. There is a 75 barrel flour mill, however, using what it requires, but at certain seasons of the year there is a great deal more than it can use, so by installing a wheel for the plant, a cheap power can thus be obtained for at least two months of the year, if not more, which would easily pay for the investment by the increased economy in running expenses.

The condenser is down cellar and is reached by an open stairway from the engine-room. The pump is 9 x 12 inches and has very little lift from the intake at the river—about four feet only—which means an easy supply of water. The discharge is piped to a hot well, built of brick and cement, with 13 inch walls and a capacity of about 500 gallons. The fact of this constant and ever-ready supply of water for fire buckets was a redeeming feature in the cost of insurance.

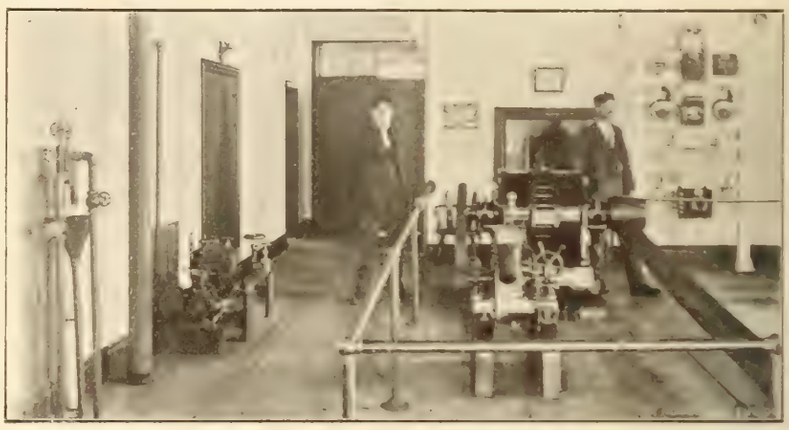
The boiler feed is a duplex steam pump 5¼ x 3½ x 6. The suction is piped to the hot well and also direct to the river, thus insuring a constant supply at all times. Besides the discharge to the boiler, there is also a valve and connection for hose, in case of fire. This feature



Alliston Electric Light Plant—View of Generator.

effected another substantial reduction in insurance and combined with the hot-well, was the principal factor in reducing the former rate by about one dollar per hundred. In case of accident to the pump there is an auxiliary feed, in the form of a Penberthy injector of suitable capacity.

The boiler is a flush-front return tubular 63 x 14, with 84 three inch flues and tested to 180 lbs., giving a safe working pressure of 120 lbs. if desired. The smoke-stack is 76 feet high, 60 feet of iron, 28 inches in diameter, standing on a base of brick and stone 16 feet high, built on the side wall of the building, and connected with the boiler by a smoke pipe of the same size as the stack. In setting the boiler, the drawings, which called for 18 inch walls, were exceeded and a 22 inch wall substituted. From the way the boiler now holds steam when standing, it is thought that the increased expenditure was more than justified. It will be of interest to many to know that the new plant is now running all steam and driving much heavier loads



Alliston Electric Light Plant—Exciter and Switch-board.

with a fuel consumption of one-half cord wood less per night than was required by the old plant assisted by 40 h. p. of water through the greater part of the year.

The old plant, by the way, consisted of a Killey automatic slide valve engine 14 x 22 and a return tubular boiler 60 x 13, on which a working pressure of 60 lbs. only was allowed by the Boiler Inspection and Insurance Company, so it will be seen that the contrast between the old and new is very marked.

The electrical equipment of the plant consists of a 60 k.w., type A., S. K. C. alternator, installed by the Royal Electric Company about three years ago, and an Edison bi-polar exciter of 1½ k. w. The switch-board is of wood, but being of neat design and painted, this is a feature easily overlooked. The lightning arresters are three in number, two of the Wurt's type and one of the S. K. C. The ammeters are of the round pattern, manufactured by the Royal Electric Company, while the voltmeter is square and of Canadian General Electric manufacture. The switches are four in number and are mounted on white marble bases. Two of them, double pole single throw, are on the main lines, while the other two, double pole, double throw, are on the voltmeter and street lighting circuit respectively. The rheostat is of the box type and is mounted on the face of the board. It will be noticed in the illustration that the lines leading outside from the board to the pole line are only connected in temporarily, on account of the ceiling not yet being finished.

For street lighting the alternating enclosed arc lamp is used, connected in multiple across the secondaries of a separate primary circuit, which is controlled from the switch-board. Light for two weeks in winter and for three weeks in summer is obtained from one trimming

of the carbons, although the lamps are inspected and inner globes cleaned regularly once a week. On the incandescent circuit they are now driving in the neighborhood of 1000 lights, but it is expected to increase this number considerably during the year, having already added on over 100 lights since the completion of the plant.

Mr. W. J. Fletcher, who has for many years been associated with electric lighting at Alliston, is superintendent of the plant, and Mr. R. H. Martindale is the electrician in charge. To Mr. Fletcher is largely due the credit of the excellent general plan and layout of the building and the quality of the work done during construction, for he personally superintended all building operations. Taken altogether and in comparison with other places, Alliston has a plant of which its owners may be justly proud.



Alliston Electric Light Plant—Power House.

THE KINGSTON LIGHTING PLANT ARBITRATION.

Judge Lount has handed out his judgment on the motion of the Kingston Light, Heat and Power Company, of Kingston, Ont., against the award of the arbitrators appointed by the city and company. He has dismissed the motion with costs, holding that the company is not, under the agreement, entitled to be paid for its franchise—valued by the arbitrators at $80,000—nor that it is entitled to the 10 per cent. statutory addition to the value of the plant.

In July, 1896, the company contracted with the city to light the streets for a term of five years running from 1st January, 1897. Clause 13 of this agreement gave an option to the city to purchase the "works, plant, appliances and property" of the company at the end of the five years at a price to be fixed by arbitration. Clause 15 of the agreement provided that in the event of the "works, plant and property" of the company being purchased by the city, the company should cease to exist as a corporation and should surrender and set over to the city "all the rights, franchises, privileges and immunities."

The City Council decided to exercise the option to purchase the company's property and plant and gave the necessary notice. The arbitrators appointed were Judge McDougall, of Toronto, for the city, Judge Price for the company, Judge McTavish, of Ottawa, being the third appointed by the first too. All three arbitrators agreed in valuing the plant and property—that is the tangible assets—of the company at $170,373. All three arbitrators agreed in valuing the franchise of the company at $80,000. At this point, however, a difference of opinion arose as to the proper interpretation of the agreement. Judge McDougall and Judge McTavish held that the city never contracted to purchase the company's franchise at a price to be fixed by arbitration; but that when the city acquired the company's works and tangible property under clause 13 of the agreement, the company should under clause 15 cease to do business and should surrender its franchise to the city. On the other hand, Judge Price was of opinion that the city had contracted to buy the franchise at a price and should pay the $80,000 at which the franchise was valued. Judge Price was also of opinion that the city should pay the company the present value of 10 per cent. on the $170,373 as is provided by statute in the case of compulsory expropriation of gas and electric plants.

In the result the award meant that the city should pay $170,373 for the company's plant and property and nothing for the franchise. The company moved against this award and sought to have it amended by adding to the $170,373 the sum of $80,000 for franchise and also the present value of ten per cent. on the $170,373. This motion is by the judgment just delivered dismissed with costs, the city thus succeeding on all points.

MOONLIGHT SCHEDULE FOR MAY.

Day of Month.	Light.	Extinguish.	No. of Hours
	H.M.	H.M.	H.M.
1....	P.M. 7.30	P.M. 3.10	7.40
2....	" 7.30	" 3.40	8.10
3....	" 7.30	" 4.15	8.45
4....	" 7.30	" 4.15	8.45
5....	" 7.30	" 4.15	8.45
6....	" 7.30	" 4.15	8.45
7....	" 7.30	" 4.15	8.45
8....	" 7.30	" 4.15	8.45
9....	" 7.30	" 4.00	8.30
10....	" 7.30	" 4.00	8.30
11....	" 7.30	" 4.00	8.30
12....	" 10.15	" 4.00	5.45
13....	" 11.00	" 4.00	5.00
14....	" 11.30	" 4.00	4.30
16....	" 0.00	" 4.00	4.00
17....	" 0.30	" 4.00	3.30
18....	" 1.00	" 3.45	2.45
19....	" 1.30	" 3.45	2.15
20....	No Light.	No Light.	
21....	"	"	
22....	"	"	
23....	A.M. 8.00	A.M. 10.00	2.00
24....	" 8.00	" 10.40	2.40
25....	" 8.00	" 11.20	3.20
26....	" 8.00	" 0.00	4.00
27....	" 8.00	" 0.30	4.30
28....	" 8.00	" 1.15	5.15
29....	" 8.00	" 1.45	5.45
30....	" 8.00	" 2.15	6.15
31....	" 8.00	" 2.45	6.45
		Total.....	162.05

The Port Dover Berlin Electric Railway Company has changed its name to the Grand Valley Traction Railway Company.

Mr. R. J. Wilson, manager of C. P. R. Telegraphs at Kingston, Ont., for the past fifteen years, has been appointed superintendent of the Oshawa Electric Railway.

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Advertising rates sent promptly on application. Orders for advertising should reach the office of publication not later than the 28th day of the month immediately preceding date of issue. Changes in advertisements will be made whenever desired, without cost to the advertiser, but to insure proper compliance with the instructions of the advertiser, requests for change should reach the office as early as the 26th day of the month.

SUBSCRIPTIONS.

The ELECTRICAL NEWS will be mailed to subscribers in Canada, or the UnitedStates, post free, for $1.00 per annum, 50 cents for six months. The price of subscription should be remitted by currency, registered letter, or postal order, payable to the C. H. Mortimer Publishing Company of Toronto, Limited. Please do not send cheques on local banks unless 25 cents is added for cost of discount. Money sent in unregistered letters will be at senders' risk. Subscriptions from foreign countries embraced in the General Postal Union $1.50 per annum Subscriptions are payable in advance. The paper will be discontinued at expiration of term paid for if so stipulated by the subscriber, but where no such paid-standing exists, will be continued until instructions to discontinue are received and all arrearages paid.

Subscribers may have the mailing address changed as often as desired. When ordering change, always give the old as well as the new address.

Subscribers are requested to promptly notify the publishers of failure or delay in the delivery of the paper.

EDITOR'S ANNOUNCEMENTS.

Correspondence is invited upon all topics coming legitimately within the scope of this journal.

The "Canadian Electrical News" has been appointed the official paper of the Canadian Electrical Association.

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Costs and Charges for Electric Light.

THE Electrical Review, of New York, has collected from electric lighting companies some valuable statistics regarding the cost of fuel, the rates charged for electric current, and the basis of charge. The highest price paid for coal is $6 per ton, and the lowest price $1 per ton, the latter representing slack coal and the former "run of mine." The average price is $2.96 per ton delivered at the plants. It would seem from the figures that the price of fuel is in many instances but a minor factor in determining the cost of electric current, inasmuch as in the Middle States, where the average cost of coal is $2.29 per ton, the base charge for power is 12 cents per kilowatt-hour, while in the Western States, where coal costs an average of $3.68 per ton, the average charge is only 7.5 cents per kilowatt-hour. If the figures are to be taken as correct, there are other elements than the cost of fuel which are of more importance in determining the charge to be made for current. The highest base rate of charge made anywhere is 20 cents per kilowatt-hour, this rate being confined to a few stations in the Eastern States. The average base charge, taking the entire country into consideration, is 12.3 cents per kilowatt-hour, while the average minimum charge to large consumers is 5.1 cents. The method of charging for current is now confined very largely to the meter system. The statistics show that 87 per cent of the supply stations use the meter basis exclusively, while only 9 per cent. adhere to the old contrast basis, and 4 per cent. use both the contract and meter basis.

Electric Power in Montreal

THE Shawinigan Water Power Company have officially announced that they will be prepared to deliver electric power in Montreal in September of this year. The contract for the transmission line has been awarded, and we are told is to be carried to a speedy completion. The company are certainly exhibiting much confidence in the prospective demand for electric power in Montreal, where at this present time there does not appear to be a very promising opening for another company. It is hoped that they may not be doomed to disappointment. To say the least, the directors of the company are enterprising, as in the face of the defeat by the Quebec Legislature of a bill which was intended to give the company the necessary rights for the distribution of power in Montreal, it is proposed to proceed with the enterprise. It may be that their plans are being concealed, but unless privileges can be secured from some of the existing companies, it is difficult to see how they will be able to operate in Montreal. The antipathy which exists against the placing of more poles and wires in the streets, is believed to be too strong to admit of the privilege being granted to the Shawinigan Company. Possibly they are relying on underground construction as a final resort, but in such case the territory in which they could operate would be extremely limited. While there are doubtless some advantages in placing wires underground, such work must be considered as a business proposition. It is only in thickly populated districts that underground construction can be resorted to with profit. To construct one hundred feet of underground conduit for two and three-phase circuits costs, it is estimated, in the neighborhood of one thousand dollars. However

this cost alone, therefore, a considerable sum must be realized from the sale of current to customers situated within that space. This sum is greater than can be obtained in outlying districts or in any district where there are not large users of current. True the cost of maintenance of underground conduits permits of a saving as compared with overhead work. Another point in connection with underground conduits is that the expediency of placing high and low potential wires in the same conduit has not yet been satisfactorily settled.

Electric Shocks.

Three papers on "Electric Shocks" were read at a recent meeting of the British Institution of Electrical Engineers. The papers and the discussion which followed, show that very different views are held as to the amount of current that will cause death, and that it depends very largely upon conditions. It was generally admitted that pressures below 600 volts are not liketo produce fatal results, while above 1000 volts the danger increases rapidly. Upon the resistance of a person depends to a large extent the result. If a person is in feeble health, death might be caused by a pressure of 500 volts. One speaker placed the resistance of a person at 60,000 ohms, but this was generally believed to be too high. The most valuable experiments regarding electric shocks were claimed to be those of Dr. Bleile, whose results were deduced from about one hundred and seventy experiments on dogs. With high alternating currents, arrest of respiration was the first thing required,and in these cases artificial respiration was successful. With low tension currents —120 volts and less—there was no effect on the respiratory organs, and the heart was thrown into a condition of contraction from which it did not recover,and artificial respiration was fruitless. It was found, however, that if within a given time,while the heart was in this state of contraction, a high tension current was passed through it, the heart would begin to beat, respiration would cease,but would be restored artificially. At the close of the meeting a number of persons presented themselves for tests, and it seemed to be agreed that what was required was some way of stimulating the heart of a person in suspended animation through electric shock.

Design of Electric Plants.

THE skill with which the engineer overcomes difficulties, incident to physical conditions is illustrated in the design of a transmission plant in Mexico, a description of which appears in a recent issue of the Electrical World. The available falls, five in number, were scattered over a considerable area and were located on two streams. The difficulty of constructing canals or flumes to bring the water to one central point of development rendered it advisable to build a small power house at each fall. This, of course, increased the attendance required as compared with a single large power house, and the cost of construction was also greater. While wooden flumes over ravines are used in this country, masonry aqueducts were in this case adopted. The generating units were of 225 kilowats, the periodicity 50 cycles, and the voltage 22,000. When required the whole system is worked in multiple with the utmost freedom, the entire nineteen generators being sometimes thrown together. In connection with the switch-board, fuses are placed between the generators and the bus-bars, the advantage of which is in preventing the switch-board from being destroyed in case of short circuits. Metal poles are used for the transmission line. A storage battery with a reversible rotary converter is a feature of the main sub-station. In the distribution of the current for lighting and power in the city of Mexico, a primary voltage of 2,600 is used, and part of the primary distribution is underground. The secondary distribution is a two-phase system worked at 240 volts for motors and with a fifth wire converting the lighting system into an ordinary alternatiug current three-wire system at 120 volts on a side.

Some Lessons from New South Wales.

A gentleman who recently spent some time in visiting Canada after having lived many years in New South Wales, had some interesting things to say about that country. He describes it as a country of vast natural wealth. As evidence of its development he points to the fact that, although the population is only 800,000, the export



THE LATE WILLIAM HAMILTON, of Peterborough, Ont.

trade amounts to £3,000,000 annually. He states that New South Wales appears to be the Mecca towards which political theorists and economists tend, and in consequence socialistic ideas prevail to a much larger degree than in Canada. For example, all railways, telegraph lines, and public works of every kind are managed directly by the government. Asked regarding the result of these conditions, his reply was that under the prevailing system the cost of public works is very much greater than would be the case under our system of constructing such works by contract. Another deplorable result is that a system of bribery and corruption universally prevails, and the standard of public morality has become impaired. Some years ago the government of New South Wales borrowed a large sum of money for the purpose of constructing a railway from one end of the country to the other, a distance of about 1,000 miles. This money, however, has never been used for the object for which it was borrowed, but has been diverted and frittered away on a great number of minor objects. Much of it no doubt has found its way into the pockets of the politicians. There is here food for reflection for the press of this country and those who are clamouring for the control by the government and the municipalities of all kinds of business enterprises.

QUESTIONS AND ANSWERS

"Subscriber," Windsor, writes : I am sending you a number of cards which I took from our Wheelock engine under different conditions. You will notice a little kink shortly after the cut-off, which I would like to know the real cause of. You will notice one card without it. I took over 20 diagrams in half a day and they all show the kink except one. Let me know what you think of the cards in general.

Ans.—You have not given sufficient data to enable us to give an intelligent answer, but we believe that the trouble is with your indicator. Sometimes a kink such as is shown is caused by the indicator being a little stiff ; in other cases by vibration. On the whole the cards are very good.

"Reader," Smith's Falls : Please answer the following qnestions in the next issue of the Electrical News. I am operating a 10x10 high speed engine running at 362 r.p.m. The h.p. of this engine as given by the makers at 300, 325 and 350 r.p.m., steam pressure 80 lbs, is 48, 52 and 56 h.p. respectively. In calculating the h.p. I make it 116.80—where am I wrong ? I find the area of the piston to be 78.54 sq. in., travel of piston for each rev. 20 in × 362 r.p.m. ÷ 12 = 603 × 78.54 = 47359 ÷ 33,000 = 1.43 h. p. the value of 1lb steam. What is meant by M.E.P., I.H. P. and initial steam pressure ? In changing from 1,000 to 2,000 volts primary, and where the primary of the present transformers are only wound for 1,000 V, would it only be necessary in order to make them work on 2,000 V. to double them up on the poles, and connect the primaries in series ; the secondaries are wound for both 52 and 104 V.

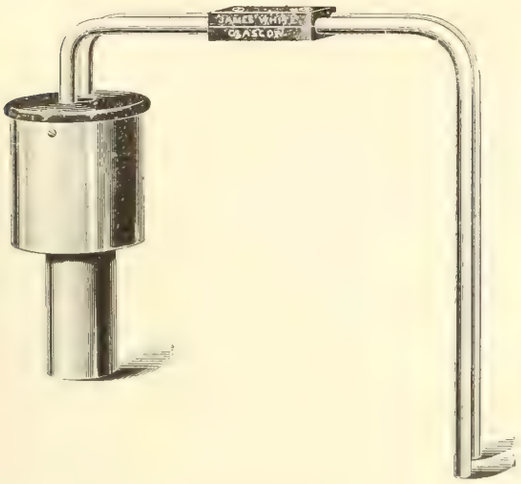
Ans.—Your error lies in the point that you used 80 lbs. the initial pressure, as the continuous pressure existing all the time in the cylinder, whereas you should use the average, or mean effective pressure, as it is usually termed. For 80 lbs. initial pressure, non-condensing, and cutting off about 1-5 stroke, this average will be about 35 lbs., somewhat less than half that supplied by the boiler. M.E. P. is the abbreviation of "Mean Effective Pressure, by which is meant the average or mean of the varying pressure in the cylinder during a stroke. At the start and up to the point of cut-off the full boiler pressure exists, from there onward it gradually decreases with the expansion until it reaches zero with the opening of the exhaust. The M.E.P. is the average of all these varying quantities which is effective for work on the piston during the whole stroke. I.H.P. is the abbreviation of "Indicated Horse Power" used to designate the horse power developed in the cylinder of an engine, as distinguished from the usual rating of horse power, which in most cases is taken to mean the output of the engine, after deducting the losses in itself, available for useful work. The initial steam pressure is the pressure of the steam at any instant up to the point of cut-off, as distinguished from the M.E.P. or the pressure at any given instant after the steam valve has closed. It is the same as the boiler pressure minus the losses in the piping. You can connect your transformers as you describe if care be taken to put their secondaries in parallel by means of leads of fairly large cross-section, no load being taken off them between the point where they join and either of the transformers. It is advisable to pair only those of the same make and the same size, and they should preferably be mounted on the same pole ; if further apart it is a question if it would not pay you better to buy new transformers than to erect the various wires necessary. The proposition is not at all a simple one, and should be carefully considered before work is started.

"Student" asks : 1st. Is there any loss of current or electrical force in the mechanism of an open arc direct current series lamp, taking 9.6 amperes at 45 to 50 volts, and if so, how many watts are lost ? If loss takes place it would seem that the last lamp in a series on a line would have much less force acting on it than the first lamps receiving the current from the station dynamo, a loss of force proportionate to the number of lamps on the circuit. 2nd. Where is the proper point to measure the voltage supplying an open arc direct current series lamp, is it where the current enters or is attached to the lamp, or is it in the arc itself ? Is it possible to measure the voltage in the arc, and if so, how is it so measured. 3rd. Is there such a term as a true watt used in electrical parlance, and if so, what is the difference between a true watt and a plain ordinary watt.

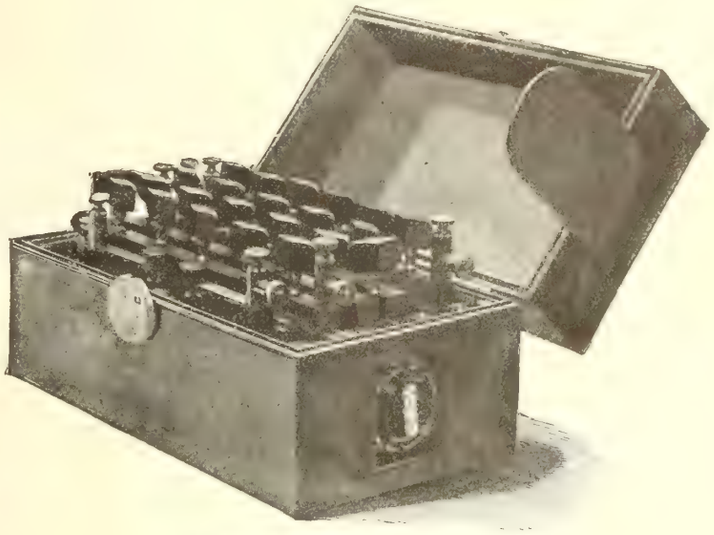
Ans.—1st. Strictly speaking, the only "loss" in a lamp such as you describe is the voltage drop due to the resistances of the various parts of the lamp through which the current has to pass. The lamp consumes 9.6x50 or 480 watts ; part of this, 90 to 95 per cent. is used to produce useful light, which is the result sought, and therefore is not a loss ; the balance consumed by the resistance, and manifesting itself in the shape of heat, which is not of any use, is a loss. The energy consumption of all the lamps in a circuit, presuming that their adjustments are similar, is the same for each one, though, as each lamp takes say 50 volts to operate it, there will be a steadily decreasing pressure all along the line until between the last lamp and the negative terminal of the dynamo there will be only 50 volts, while between the first lamp and the same terminal there will be, on a 50 lighter, 2,500 volts, at the second lamp 2,450, at the third 2,400, and so on. 2nd. It depends what you are measuring for, if you want to get the voltage of the complete lamp you would connect your meter across the lamp terminals, but if you desire to get the voltage of the arc only, the meter should be connected to the carbons or the carbon holders. 3rd. The term true watts is sometimes used, in alternating correct work, to distinguish that part of the current in a circuit which is in phase with the voltage from that part which is out of phase. To illustrate, a single phase machine may be carrying a load of 100 amperes at 1,200 volts, which gives an apparent kilowatt output, or as it is more often called, kilo volt amperage, (written for short kva), of 120. Now, if the power factor is 80%, the real kilo watts are 80% of 120, or 96, which is then said to be the true watts. The term is not found very often, the abbreviations kva and kw being now in general use to indicate, the first the apparent or volt amperes of the circuit, the second the true or actual watts. It of course follows that if the power factor is 100% or unity, the two are the same.

DOMINION GOVERNMENT ELECTRICAL STANDARDS.

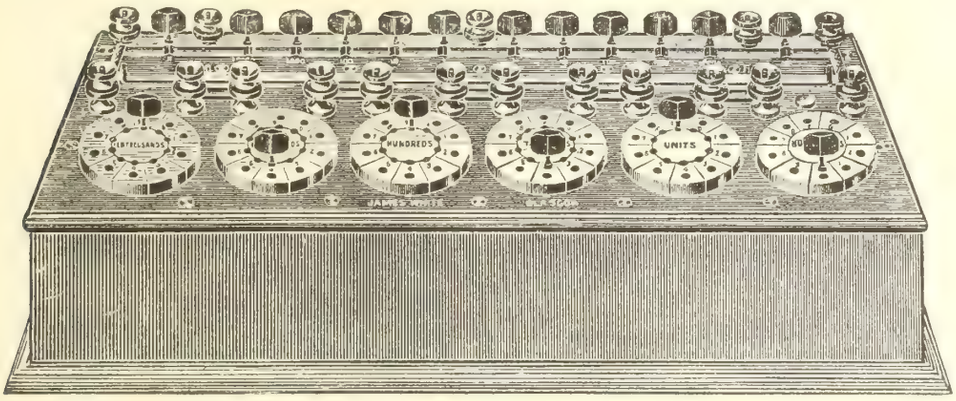
On the following pages will be found illustrations of the principal apparatus procured by the Inland Revenue Department at Ottawa as standards of electrical measure. These instruments have been selected by Mr. O. Higman, chief electrical engineer, and are in compliance with the requirements of the Electrical Units Act passed in 1894. A description of the different apparatus was given by Mr. Higman in a paper read before the Canadian Electrical Association in June, 1901, and published in the Electrical News for July of that year, to which the reader is referred.



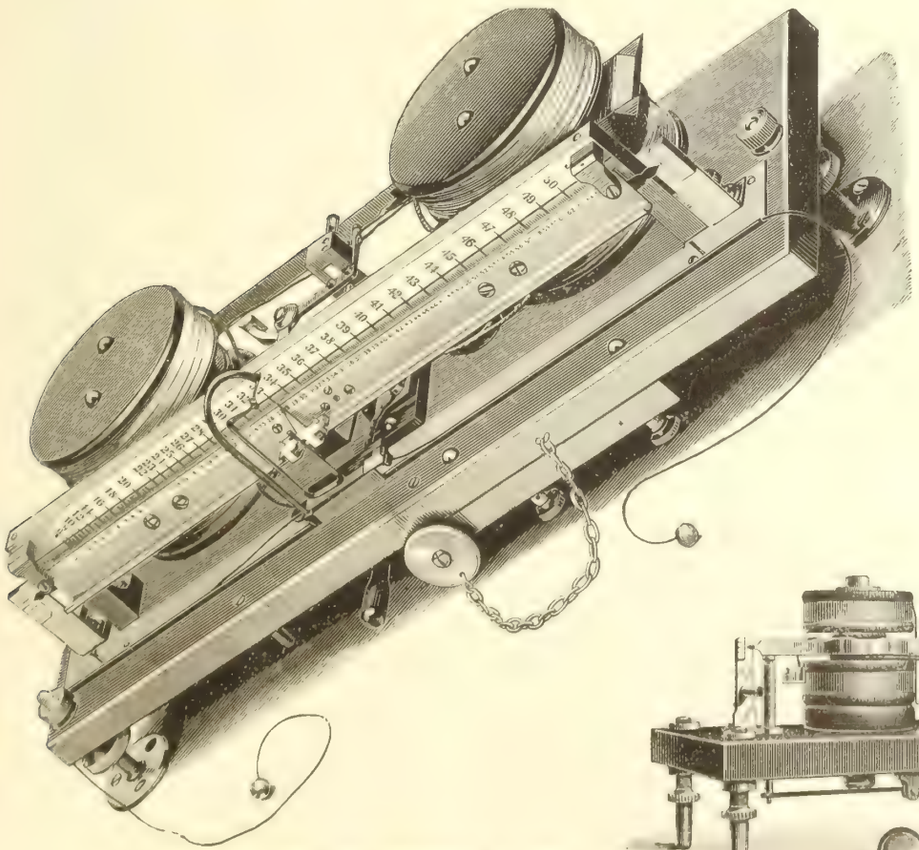
THE STANDARD OHM.



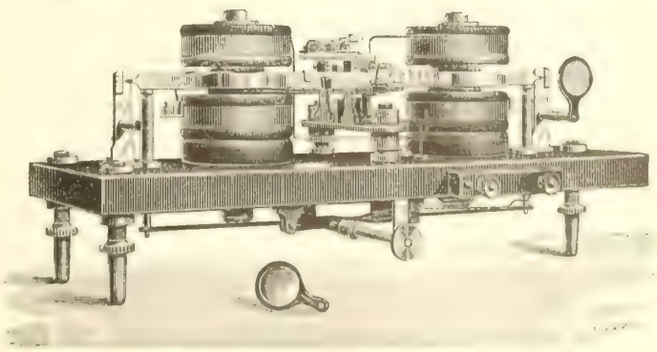
STANDARD RESISTANCES MULTIPLES.



WHEATSTONE BRIDGE.

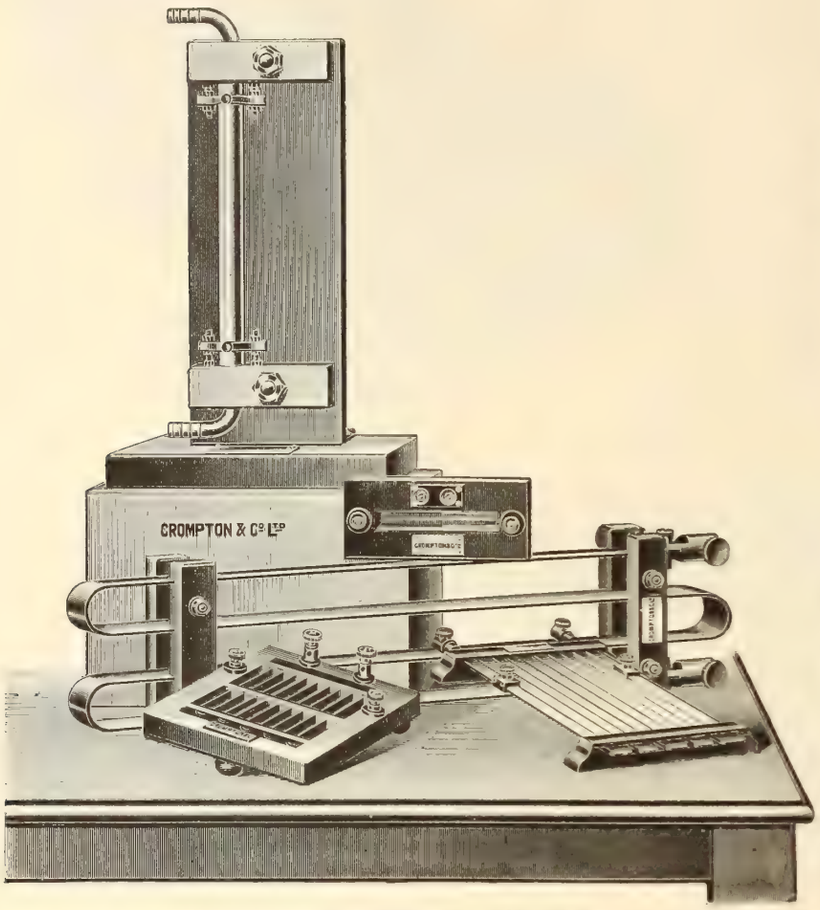


KELVIN STANDARD CENTI-AMPERE BALANCE.

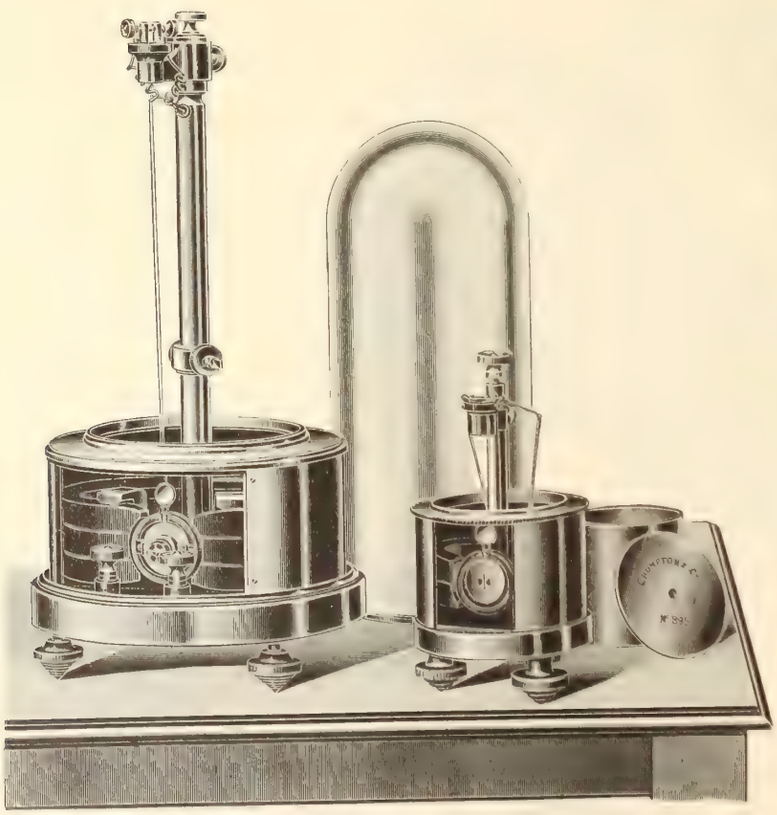


KELVIN STANDARD AMPERE BALANCE.

DOMINION GOVERNMENT ELECTRICAL STANDARDS.

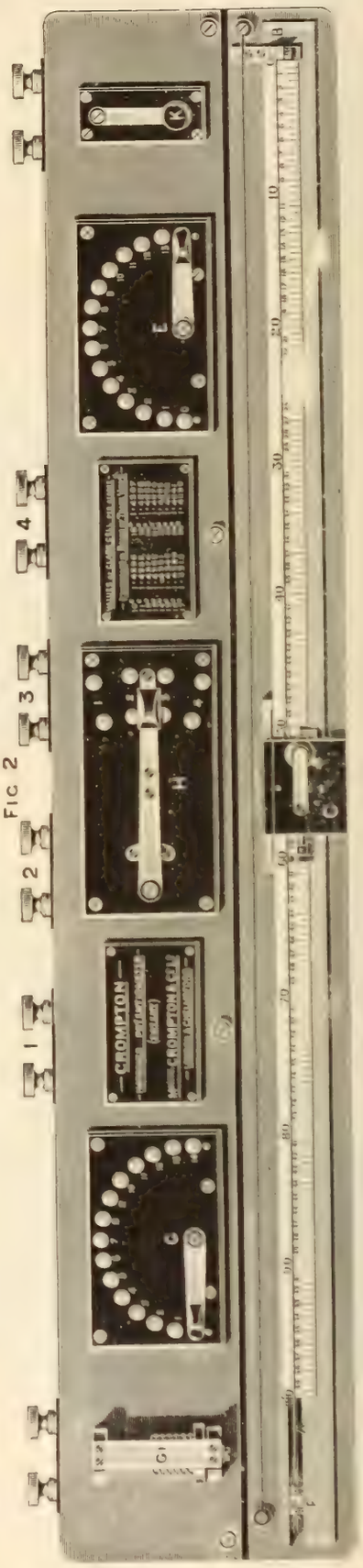


STANDARD RESISTANCES—SUB-MULTIPLES.



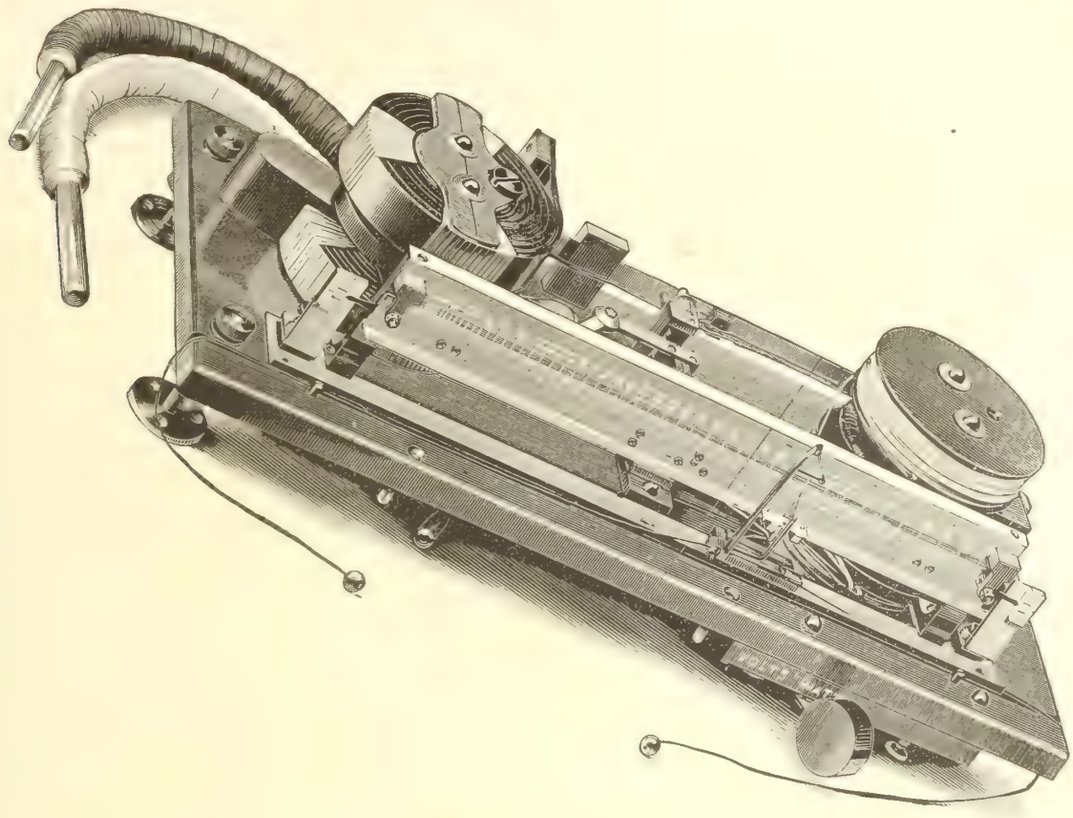
STANDARD HIGH-GRADE D'ARSOUVAL GALVANOMETERS.

FIG 2

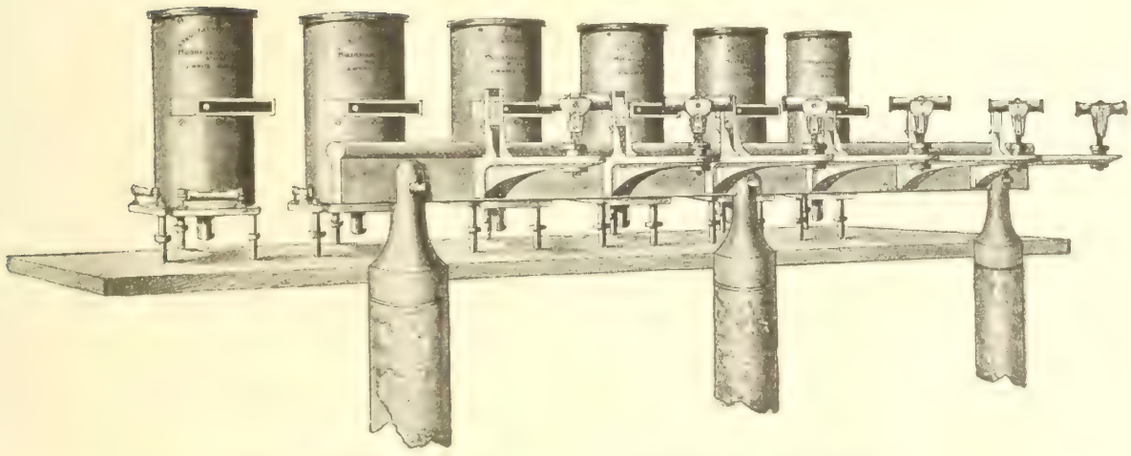


CROMPTON POTENTIOMETER.

DOMINION GOVERNMENT ELECTRICAL STANDARDS.



KELVIN STANDARD COMPOSITE BALANCE.



KEVLIN STANDARD ELECTRO STATIC, MULTICELLULAR VOLTMETERS.

DOMINION GOVERNMENT ELECTRICAL STANDARDS.

SCRANTON ENGINEERS' CLUB ELECT OFFICERS.

At the annual meeting, on January 23rd, 1902, of the Engineers' Club, Scranton, Pa., the following officers for the ensuing year were elected : President, H. H. Stoek ; vice-president, B. F. La Rue, professor of civil engineering in the International Correspondence Schools; Secretary, A.E. Lister; Treasurer, F. J. Platt ; Corresponding Secretary, A. B. Dunning ; Librarian, H. M. Lane, Professor of Mechanical Engineering in the International Correspondence Scoools; Directors, W.M. Marple, C. C. Rose,and H.W. Rowley. President Stoek is the able editor of "Mines and Minerals," the well known mining publication issued by the International Textbook Company, Scranton, Pa., proprietors of the International Correspondence Schools.

SPARKS.

We are advised that the business of the Pittsburgh Transformer Company has reached such a volume during the past year, that the company has about completed arrangements to carry stocks of its Type K transformers in several of the principle cities of Canada. In the United States the company carries stocks in Philadelphia, Pittsburgh, Chicago, and San Francisco, from which prompt deliveries are made. The trade grows more and more impatient of delay in filling transformer orders, and the policy of the Pittsburgh Transformer Company directed towards making all shipments from stock on receipt of order has been highly appreciated by central station people.

The Washtenaw Electric Company, of Ypsilanti, Mich., using Pittsburgh transformers, recently reported an unusual case of overload carried by this make. Two ten kilo-watt transformers were carrying between them a store and opera-house load which on Saturday nights was very heavy. The fuse on one of the 10 kilo-watt transformers blew for some reason, and the remaining 10 kilo-watt transformer carried the combined load of both, from Saturday night until Wednesday night without burn-out. The oil transformer, of which the Pittsburgh Type K is a good example, possesses unusual ability to take care of overloads such as the above case, which is one of the reasons why oil has taken such a strong hold in transformer work.

CORRESPONDENCE

INSPECTION OF INTERIOR WIRING.

MONTREAL, March 28th, 1902.

Editor CANADIAN ELECTRICAL NEWS :

Dear Sir :—As an old subscriber, and as an electrician who has been many years connected with the "craft," the letter signed "Inspector" is full of interest. In the main his remarks are strictly in order, but he has to my mind not hit out from the shoulder sufficiently at those most in fault, viz., the Canadian Board of Fire Underwriters themselves. I take it that "Inspector" is a Montrealer, and that his remarks (as do mine) pertain to Montreal in particular. The Underwriters admit themselves in a late report, that nine-tenths of the fires caused have been by high tension," viz :—Ayer's Cold Storage, T. Paton, Guardian Building, etc. Now, as their regulations cover outside wiring as well as interior, why do they not make some attempt to control it, as they do the interior ? It is a well known fact that no matter how good an installation may be made for 110 volts, that not one in a thousand will not immediately be put "hors de combat" with 2,000 volts. No, instead of this they not long ago stamp their inspection reports that further inspection of the premises can be had from "the lighting company"; in fact allowing law breakers to be law makers and placing a reputable contractor at the diction of possibly a discharged employee who may have been taken up later by a lighting company as one of their inspectors. I do not say that such inspectors have shown any animus, but the loop-hole is open. Again, although as before mentioned an attempt (not very great) is made by underwriters at inspection of interior wiring for public and business buildings, yet no attempt whatever is made at same in private residences, although one of same might be right alongside of just such a public building, and by bad wiring cause a fire which might entail the loss of the public building in itself wired according to rule.

I venture to assert that there is not one secondary connection from transformer to building in the city of Montreal that comes strictly under the regulations. Further, sufficient discrimination is not used in feeding one or more residences from the same transformer. Often a residence lately wired is connected to the same main as one wired half a dozen years ago, thus bringing the good installation down to "par" with the bad. Underground wires, "high tension," would certainly cure some (not all) of the evils existing, but in all fairness to the lighting companies and to the customer who in the end pays the bill, no command for doing this immediately should be promulgated, but a convenient future date set at which time such conditions would be "un fait accompli."

By no means be it supposed that I believe interior wiring is all right. As 90 per cent. of the public accept the cheapest offer and as "Inspector" in his letter intimates, there are "tramp" wiremen irresponsible enough to accommodate that class. Interior wiring should be fully and compulsorily inspected, but as it is often and often made dangerous by outside conditions, the two should be inspected conjointly. How ?—by the underwriters having nothing to do with inspections further than paying one-half the salary of a competent and energetic inspector, the other half being paid by the city. This would prevent individual insurance companies over-riding underwriters, etc., as complained of by "Inspector." A last word regarding the "Press," whose scare headings "Inspector" also mentions : They may not be aware that their action has already begun to make some people quite nervous, and yet some of those very newspaper offices are subject to similar accidental conditions with their own wiring. They might also have the decency to use an equally heavy type for their disclaimer, as for instance, Lariviere's fire was heralded as electric in bold type, but when afterwards found to have been caused by a forge it was only deemed worthy of mention as unobtrusively as possible.

I do not wish to trespass further on your valuable space, but am quite willing to say "more anon" if necessary, as for instance on the cost of our present official inspections, the folly of asking certain risks to pay 25 cents per hundred extra, or get re-inspection every three months, etc.

Yours truly,

"JUSTICE FOR ALL."

Tenders are being taken by the Council of Cornwall, Ont., for lighting the town by arc and incandescant lights for periods of five and ten years.

MONTREAL

Branch office of the CANADIAN ELECTRICAL NEWS
Imperial Building,

MONTREAL, April 2nd, 1902.

Mr. George Thompson, electrician, formerly of Belleville, Ont., has joined the ranks of the Lachine hydraulic forces. Those who know George have found him "all right," and wish for him every success in his new sphere.

A visit to the R. E. T. Pringle Company's new ware-rooms presided over by Mr. Rough, the vice-president of the new company, would lead one to infer that they intend to do "the" trade of Canada, and Mr. Rough looks as if he meant it too.

Contractors report that after a slack month or two enquiries are now coming in rapidly and work is picking right up. Prospects for a lively spring are good.

The Canadian General Electric Company have sold a pair of 220 volt D. C. generators to Messrs. H. Lamontague & Company for a light and power plant in the new factory, formerly the Balmoral hotel building. Construction is being done by the Montreal Electric Company.

We hear that Messrs. Fred Thomson & Company have secured orders from the Marconi Wireless Telegraph Company for the manufacture of some step-up transformers of a unique type for use in the C. B. transmitting station.

The electric installation at Shawinigan Falls for the new Belgo-Canadian Pulp Company was performed by the Montreal Electric Company, the specifications being by A. C. Rice, M. E., of Worcester, Mass.

The Electrical Workers Union claim to be increasing their membership steadily, and contemplate providing a course of instructive lectures in the course of a month or so which should benefit wiremen in general. They are also attempting to secur legislation to the effect that none but those having the necessar experience will be allowed to install electric light and power wiring—a consummation devoutly to be desired !

A Montreal street railway car ran away on Guy street the other day through a brake bolt giving way. The trolley came off, and the car sped straight across the G. T. R. tracks. Luckily, no train was coming, and no particular danger to property or life ensued. On a former occasion furthur up the same street a similar, though not altogether as fortunate an accident occurred about a year ago, and a Toronto correspondent wanted to know why motorman did not reverse connections and check speed of car by dynamo action. A little further enlightenment on this subject in the pages of the NEWS might prove of benefit, especially when it appears about one of the easiest things to do. Are our cars not equipped with that style of controller, or are motormen not advised of that point ?

Mr. David A. Starr, formerly general sales agent of the Royal Electric Company and late as a consulting electrical engineer on his own account, leaves Canada shortly to take a prominent position with the British Westinghouse Co. Mr. Starr's place of residence will probably be London. There are many friends, both business and private, who will be sorry that our genial friend is going away from our midst, but who at the same time wish him "every good luck".

It is said that a case will be brought on shortly by the Alliance Insurance Company, against the Royal Electric Company, to determine whether or not the latter are liable for the fire last year at the residence of Mr. Thos. Paton on Sherbrooke street, where high voltage entered on house wiring.

We have received a copy of the third edition of Bell's "Electrical Power Transmission." When the second edition of this work was issued in 1899 the longest transmission line in commercial use was eighty miles and the highest voltage forty thousand. To-day electrical energy is transmitted successfully over distances closely approximating two hundred miles and at pressures above fifty thousand volts. In the third edition the changes that have been taken place in the meantime in connection with electrical power transmission are clearly set forth. It is stated that the greatest changes have been in the direction of the more certain and efficient management of very high voltages. A brief chapter on commercial electrical measurements has been added to the book. The publishers are the Electrical World and Engineer, New York.

TELEGRAPH and TELEPHONE

EXPERIMENTS IN LONG-DISTANCE TELEPHONY.

With a view to giving the provinces the advantage of direct telephonic communication, experiments have been going on in the North of England. According to a statement in the London Electrical Engineer, during official tests by the Post Office authorities in Leeds, it was found possible to speak with Boulogne, a distance of about 300 miles. It is understood that this is the first occasion on which a telephone message has passed between any provincial town in the North of England and the Continent, with the exception of Liverpool, which was also recently the scene of similar experiments. In this case it was found possible to carry on a telephonic communication with Paris, the distance covered being about 500 miles. Further south than Paris, however, the speaker could only be heard in Liverpool under very favorable conditions. It is said that one result of these experiments has been the abandonment of the scheme to attempt telephonic connections between London, Turin and Milan, the opinion being that these cities are too far apart to be embraced in a telephone circuit. It is to be noted, however, that the distance one can speak with the telephone largely depends on the wires through which the message has to be transmitted, and that the non-success of the authorities to obtain a satisfactory connection with the telephone between Liverpool and towns south of Paris only applies to the particular circuits on which the experiments were made. With heavier copper wires conversations have been successfully held over much longer distances.

THE TELEPHONE.

It is hardly possible to realize that only twenty-five years ago the telephone was hardly more than the dream of two or three imaginative scientists, and that it was not until at least a decade later that this means of communication began to play an important part in the daily life of a considerable fraction of the earth's inhabitants. There are still not a few million human beings who have never used or even heard of a telephone, says Telephony, but they are the millions who count for little except in their own somewhat mistaken estimations. For all the really active and effectual part of humanity the telephone has come to be something not much different from a necessity of life. Social and commercial acttivities have so adjusted themselves to the machine which gives indefinite extension to ear and tongue that were the facility, not long ago unthought of, to be suddenly withdrawn, the most serious embarrassments would follow. The efficiency of every business man would be so materially decreased that for a while at least there would be grave trouble and confusion. Yet people have already come to use the telephone without a thought of what a marvellous thing it is, and we hear vastly more about the cost and imperfections of the service than about the numberless and inestimable advantages derived from it.

TELEPHONE DECISION.

Mr. Justice Street delivered judgment last month in the case of the city of Toronto against the Bell Telephone Company. The city, in effect, claimed that the company in its local business was subject to provincial legislation, and under that legislation could not use the streets except by consent of the municipality. The judge upheld this contention, and said the proper construction of these acts treat the Ontario act as conferring special rights upon the defendants in regard to their works in that province, and at the same time subjecting them to the necessity of obtaining the consent of the local municipalities to the use of the streets, while leaving to their act of incorporation its full operation in other provinces. It was declared that the defendants have no right to carry any poles or any wires along any streets of the city of Toronto without first obtaining the consent of the municipal council, but inasmuch as the Ontario act does not make their power to carry wires across streets dependent upon the previous consent of the council, they may carry them across the streets.

There was in existence a statute of the Ontario Legislature restricting the powers of the company in these terms : "In towns and cities and in incorporated villages [the company] shall not erect any pole higher than forty feet above the surface of the street, nor carry any such poles or wires along any street without the consent of the municipal council having jurisdiction over the streets of the said city, town or incorporated village."

SEEING BY TELEPHONE.

A dispatch from Paris of December 18th, says : Dr. Sylvestre, the inventor who claims to have discovered how to see by telephone, has just described his remarkable discovery, which he declares was a matter of chance. He said : "There is no reason why as soon as telephonic cables are established between Paris and New York, we should not see our friends there as easily as I see you. I have already seen the Marseilles Telephone Exchange from this room by means of my apparatus, and I have chatted by telephone with M. Mougeot, the French Postmaster General, watched his astonishment and described his appearance, his clothes, his office as we talked." The dispatch continues : "Dr. Sylvestre showed a small circular mirror, with a hole in the centre, into which is screwed a tiny electric light of 1-10th candle power. This is fixed to a telephone's microphonic plate by an India rubber band, a pencil-like instrument connecting the current with the apparatus. Two acids are allowed to mix, drop by drop, in a torpedo-like machine, about 3 inches long. This process throws what Dr. Sylvestre terms a phosphorescent flame on the looking glass connected with the poles, and pencil and a sheet of any white, semi-transparent tissue, placed before the glass, shows the room in which the other person is telephoning no matter how many miles away that person may be.

SHORT CIRCUITS.

Why should the C.P.R. telegraphers demand more pay? Don't they live on tick?—Toronto Star.

It is understood that a company is being formed to construct a telephone line from Woodville to Glenarm, Ont.

It is stated that Signor Marconi has decided to locate his wireless telegraphy station at Table Head, Glace Bay, N. S.

The business men and fruit growers in the vicinity of Stoney Creek, Ont., intend forming a company for the purpose of constructing a local telephone system. Mr. J. B. Davis is secretary pro tem.

The annual meeting of the Valley Telephone Company was held at Middleton, N. S., on February 13th, at which the old board of directors was re-elected. The capital stock of the company has been increased to $100,000.

The Dominion Government has taken tenders for the construction of telegraph lines from St. Peter's to Main a Dieu, and on Scatari Island, a distance of 90 miles, also from Graberus to North Sydney, Cape Breton, a distance of 35 miles.

The Nova Scotia Telephone Company has elected officers as follows: President, B. W. Chapman; vice-president, R. Uniacke; secretary-treasurer, T. N. Goudge ; directors, C. F. Fraser, B. F. Pearson, R. L. Borden, M. P., Dr. A. C. Cogswell, and C. F. Sise. J. H. Wingfield has been appointed general manager to succeed the late C. E. Harris.

Mr. R. T. Hamilton, manager of the Owen Sound branch of the Bell Telephone Company, has been promoted to the position of assistant district manager, with headquarters at Guelph. He has been succeeded at Owen Sound by Mr. Karl Wildren, of London, who was presented before taking his departure with a gold watch by the staff of the London office.

The Union Telegraph Company is seeking a charter from the New Brunswick government. It is an amalgamation of the telephone lines owned by Dr. Ross, of Florenceville, and Dr. Brown, of Centreville, which cover about 200 miles of wire and about 100 offices. The main branch line extends from Woodstock to the county border at River du Chute, but the intention is to extend it to Edmundston.

The engineers and apprentices of the Westinghouse Electric & Manufacturing Company, of Pittsburg, Penn., have recently organized the "Electric Club," for the purpose of closer union and co-operation. Comfortable and commodious quarters have been secured for the Club at 735 Penn Ave., Wilkinsburg, Penn These quarters include a lecture hall, reading, recreation and class rooms. The club is supported by the dues of the members, supplemented by a subscription from the company. The organization starts out with a membership of about three hundred.

ENGINEERING and MECHANICS

THE MANUFACTURE OF IRON.

Mr. Chas Fox, superintendent of the Hamilton Steel and Iron Company, read a very interesting and instructive paper on "The Manufacture of Iron" before the Canadian Association of Stationary Engineers, Hamilton, on Thursday evening, March 13th. Mr Robt. C. Pettigrew, past president, was chairman, and the meeting was attended by representatives of the Board of Trade, the Hamilton Scientific Association and members of the Canadian Club. Mr. Charles Moseley, executive president. paid his official visit at this meeting.

Mr. Fox spoke as follows :

"The term iron as used in a general sense includes all those products obtained originally from iron ore by smelting with fuel. Under the general term iron we have pig iron, which is iron made from ores in a blast furnace and cast in the form of pigs. The fuel used may be coke, charcoal, anthracite coal, or mixtures of these, and the pig iron named according to the fuel used in smelting, as coke pig, charcoal pig or anthracite pig. Then under each of these are other classifications according to the purpose the pig is applied to, namely, basic, bessemer, foundry, malleable and mill. This mill iron is put in a pudding furnace and all the impurities, such as carbon, sulphur, etc., are worked out of it, and we have wrot iron. Sometimes wrot iron is made direct from ore without first making pig iron. This is really the process by which iron was first made. It takes a very high temperature to melt wrot iron, but it may readily be brought to a welding heat in a heating furnace and then rolled into bars. A peculiarity of wrot iron is the fibre ; when broken it presents a fracture like wood. A piece of steel in breaking shows no such fibre, only a clear uniform break. The wrot iron has slag disseminated all through it and when rolled out these lines of slag break the continuity of the metal and make the fibre.

Coming now to pig iron and the blast furnace, if we had merely to melt the iron as in a cupola, its operation would be comparatively simple, it being only necessary to maintain the proper temperature. To take oxygen away from iron and silicon away from oxygen heat is not enough ; we must have the combined action of white hot carbon and heat of special intensity. In a furnace working regularly the temperature is highest at tuyeres and gradually decreases to the throat. When the temperature becomes too high in the upper part of the furnace the partly reduced oxides in coming in contact with the silicon of the gangue, may form a fusable silicate and pass into the hearth unreduced, making scouring cinder. If temperature at zone of fusion is low, the amount of silica reduced will be small and the slag on account of this excess will be too fusible, and the iron, not being retained long enough at high temperature, will become carbonized and an inferior grade of iron is the result.

Several causes may produce improper distribution of heat in the furnace. The affinity of carbon for oxygen is greatest at high temperature ; when temperature of blast is raised, the zone of combustion contracts. Now, if the initial temperature of the air is lowered, the zone widens and the heat gets higher up in the furnace, causing fusion above and bad working. The condition of the blast is one of the principal factors in determining the working of a furnace. The temperature must first be considered, then the amount of moisture it contains. Water has to be decomposed by coke.

Ore is reduced mainly in the upper part of the furnace by the ascending gas. The impurities in the ore and stone combine to form slag. Refractory slag requires high temperature for its formation and partly reduced iron will be exposed a long time to the intense heat of the tuyeres before passing into the liquid state at the bottom of the hearth. Only slag from charcoal furnaces have potash or soda—these are very powerful in removing sulphur, making it possible to make charcoal iron free of sulphur with acid slag. Consequently the lower the carbon, the stronger the iron.

All foundry iron was formerly graded by fracture and color. This was done as carefully as possible, but it is a difficult matter to draw the line between a close No. 1 and an open No. 2. No matter how carefully grading by fracture and color is done, there must, by the very nature of things, be in every grade some pigs closer than others, and even if the grading is well done the fracture is no reliable indication of what the iron contains, all that can be deduced from the fracture of iron is that open grained iron is generally low in sulphur, and close grained is high. Careful chemical analysis is the only trustworthy means of finding out what an iron contains.

Silicon is the best known of all constituents of pig iron. It increases the fusibility of iron, lessens the formation of blow holes and reduces the chances of shrinkage. The strongest castings are obtained from iron that will produce sound castings with the least amount of silicon. Pig iron with excessive silicon has characteristic fracture, the grain is often close and flat and the color light. The most important action of silicon in iron is to convert combined or hardening carbon into graphitic or softening carbon.

Carbon exerts the most vital influences upon the character of pig iron. It affects the color, strength, hardness and fusibility of cast iron. In two distinct forms, the combined and the graphite, and upon the relative proportions of each, in a great measure depends the character of the metal.

The tendency of phosphorus is to prevent blow holes and render the metal very limpid so that it will give an extremely fine and sharp casting. The percentage of phosphorus varies in pig iron from a trace to several per cent.

Manganese assists in the prevention of blow holes. It has a great affinity for sulphur. When iron is melted with fuel containing a high percentage of sulphur the manganese seizes upon the sulphur and carries it off with the slag. It also strengthens the castings.

Sulphur is without doubt the most deleterious substance found in pig iron. It makes iron red-short, that is brittle when hot, also hard and white, sluggish and thick, causing blow holes during its solidification. Limestone is generally used for removing sulphur.

Coke for foundry use should be of the highest grade obtainable because the impurities in the coke are taken up to a very large extent by the iron in melting. Good coke has a bright lustre and a metallic ring ; it should be strong and light and low in sulphur. The only accurate way to determine the amount of sulphur in coke is to have it analyzed by a reputable chemist.

Into a blast furnace making from 3,000 to 4,000 tons of iron a day must be blown 33,000 feet (cubic) of air per minute and to do this it will probably require 350 tons of coke, and 2,000 horse power will be necessary."

Samples of Canadian ore and foundry pig iron were shown and the speaker's remarks illustrated by means of a blue print of a blast furnace and sectional drawing of a stove.

At the conclusion of the paper a vote of thanks was moved by Mr. J. G. Cloke and seconded by Mr. Geo. Black. In a few well-chosen words the chairman presented the thanks of all present to Mr. Fox, who briefly acknowledged the same.

BANQUET OF HAMILTON No. 2.

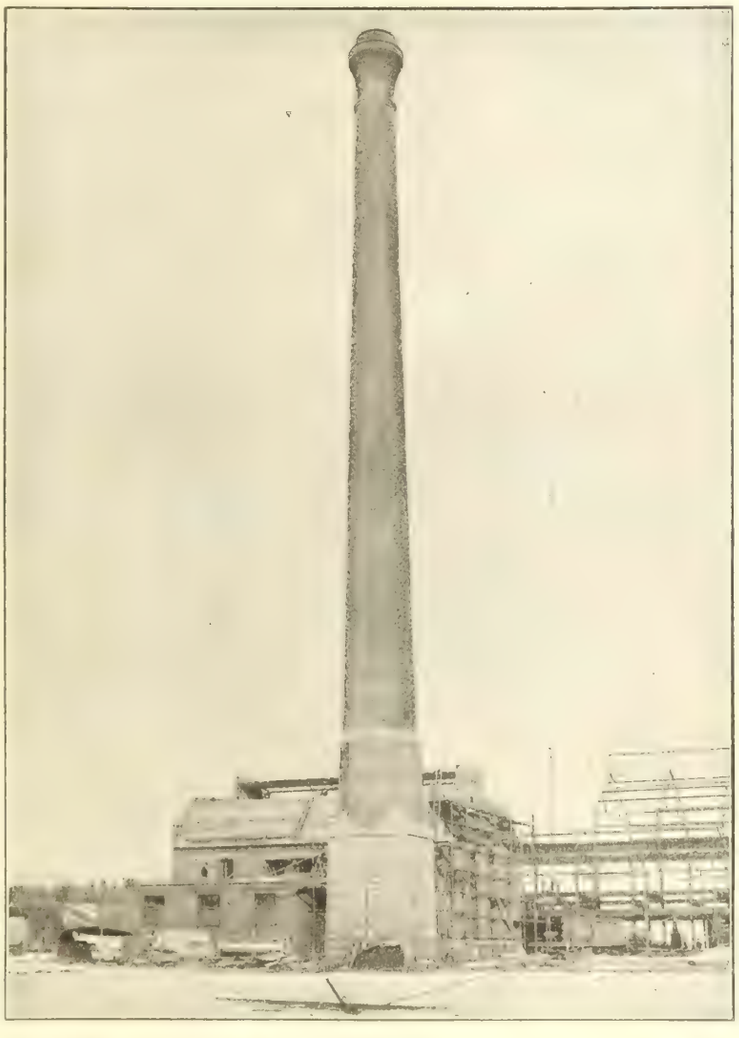
The annual banquet of Hamilton No. 2, Canadian Association of Stationary Engineers, was held at the Commercial Hotel in that city on March 27th. There was present a large party of engineers and their friends, who were entertained by an excellent luncheon, music and speech making. The toasts and respondents were as follows: "The King," by singing the National Anthem; "Canada Our Home," H. Carscallen, M.P.P.; "Hamilton the Ambitious City," by Ex-Ald. James Donald ; "Manufacturers," by I. C. Eby ; "Educational Interests," by S. J. Ireland, principal School of Art and Technology ; "The Executive Head," by Charles Moseley and A. M. Wickens, Toronto ; "Kindred Associations," by Thomas Elliott, Hamilton, W. J. Webb and James Huggett, Toronto. Those contributing to the musical programme were J. H. Allen, pianist, James Jardine, Walter Hyslop, W. Golden, Samuel Blakely and N. B. Kitchen. The banquet committee consisted of W. R. Cornish, chairman, S. J. Sculthrop, James Ferguson, J. Ironside, R. C. Pettigrew, W. Stevens, Thomas Chubb and D. Hunter.

A FINE CHIMNEY.

The Canada Foundry Company, Limited, are rapidly bringing to completion a mammoth manufacturing plant situated at the head of Mackenz e avenue, at the crossing of the C. P. R. and G. T. R. systems, in Toronto. The property consists of thirty-two acres, and the buildings at present under construction are : Machine shop, foundry, structural iron works, blacksmith shop, power house, and pattern vault. To these will shortly be added an engineering and draughting building and pipe foundry. The buildings are all fire proof, being constructed of concrete, brick and steel. The pattern vault is also provided with non-breakable glass windows set in metallic sashes, capable of resisting any fire.

The accompanying cut shows the recently completed chimney, a magnificent piece of work standing 216 feet above the foundations. At the base is situated the power house, in which will be installed a large battery of boilers, steam engines, electric generators, etc. The motive power generally used throughout the building will be electricity, but hydraulic and compressed air lifts will be utilized for chipping, riveting, caulking, etc. Each building will be supplied with electric cranes and individual compressed air lifts will be installed wherever necessary.

The Canada Foundry Company, Limited, is controlled by the Canadian General Electric Co., Limited.



Chimney at Works of Canada Foundry Company, Toronto.

LEGAL DECISIONS.

A favorable decision to the city of Ottawa has been rendered in the suit brought by the Ottawa Electric Company to prevent the city from imposing a fine for lights out. The company sought to recover $18,669.30 balance alleged to be due under a contract for lighting the streets of Ottawa. The city paid $12,485.15, and put in a counter claim for 4,482.13, being the amount of fines imposed for lights out after the big fire of April 26th, 1900. The judge held that the electric company was entitled to recover the contract price of $65 a year, less a deduction for lights out or not kept lighted when they should have been. It was held to be obligatory on the company to pay the penalty for lamps not lighted whether the cause of default be unforeseen accident or otherwise.

Hull Electric Company vs. Ottawa Electric Company.—The appeal of the first named company was dismissed by the Privy Council. The concluding clause of the judgment, which puts the main points at issue in a nutshell, is as follows :

"Their lordships think that the real meaning of the transaction was this : The city of Hull granted to Viau an exclusive right of establishing a system of electric lighting for a certain term of years, that is to say, by their grant to him they bound themselves during the period not to grant such a right to anybody else ; but at the same time they said to Viau : " You must remember that we have granted permission to the Ottawa company to establish a system of electric lighting in the city of Hull and that system is now in operation ; we bind ourselves not to convert that permission into a right, but we do not bind ourselves to revoke that permission at your bidding. We keep the power of revocation in our hands." Possibly the consideration that the Ottawa company was to be left to carry on its operations in Hull until the council saw fit to revoke its license may account for the singular fact that in passing by-law number 61, the council did not think it necessary either to impose on Viau and his associates any obligation to furnish a supply of electric light to the municipality or to those of the inhabitants who might require it, or to place any restriction upon the charges which Viau and his associates might demand. In the result, therefore, their lordships agree in substance with the second ground of the decision of the Court of Queen's bench, and they will humbly advise His Majesty that this appeal ought to be dismissed. From this judgment it appears that the Ottawa company have been given no rights in Hull, though they have been granted permission to establish there by the council and can be forced to move when the council decides. But at the same time it holds that the Hull Electric Company cannot on its motion force the other company to leave the city. Though several parts of the Quebec judgments in favor of the Hull company were reversed, the costs of the appeal will have to be borne by the Ottawa company, inasmuch as the latter's contention that they had the right to force the Hull company to leave the city was not maintained.

OIL AND COAL TESTS.

Tests of the relative efficiency of coal and oil as fuels have been made at the plant of the Dallas Electric Co., Dallas, Tex. As a result of these the following figures have been presented by J. E. Ludlow :

Tests made with mine-run McAlester coal at the Dallas Electric Co.'s plant, on Aug. 5, under boiler of rated capacity of 370 horse-power, based on ten square feet of heating surface; duration of test eight hours, from 8.30 a. m. to 3.30 p. m. :

Coal consumed, 10,000 pounds.
Cost of coal per ton of 2,000 pounds, delivered in plant, $3.15.
Water evaporated, 75,973 pounds.
Water evaporated per pound of coal, 7.59 pounds.
Temperature of feed water, 90 degrees.
Evaporated from and at 212 degrees, 8.87 pounds.
Steam pressure, 110 pounds.
Factor of evaporation, 1.169.
Cost of coal to evaporate 75,973 pounds of water, $15.75.

Evaporation test of Beaumant crude oil at the Dallas Electric Co.'s plant, under boiler of rated capacity of 370 horse-power, based on ten square feet of heating surface, using one burner, duration of test eight hours, from 10.25 a.m. to 6.25 p.m., Aug. 17 :

Oil consumed, 6447.5 pounds.
Weight of oil per gallon, 7.43.
Water evaporated, 75,985 pounds.
Water evaporated per pound of oil, 11.78.
Temperature of feed water, 90 degrees.
Steam pressure, 110 pounds.
Factor of evaporation, 11.69.
Evaporated from and at 212 degrees, 13.77.
Cost of oil to evaporate 75,985 pounds of water at 59 cents per barrel of 42 gallons, $12.19.

ON GROUNDS FOR LIGHTNING ARRESTERS.*

Great importance must always be attached to the making of proper ground connections for lightning arresters, which should be as short and straight as possible from the arrester to ground. It is obvious that a poor ground connection will render ineffective every effort made with choke coils and lightning arresters to drive the static electricity into the earth, and it is, therefore, important not only to construct a good ground connection, but also to appreciate thoroughly the necessity of avoiding unfavorable natural conditions.

A good ground connection for a bank of station arresters may be made in the following manner: First, dig a hole six feet square directly under the arrester until permanently damp earth has been reached ; second, cover the bottom of this hole with two feet of crushed charcoal (about pea size); third, over this lay 25 square feet of No. 16 tinned copper plate ; fourth, solder the ground wire, preferably No. 0 copper, securely across the entire surface of the ground plate; fifth, cover the ground plate with two feet of crushed charcoal; and sixth, fill the hole with earth, using running water to settle.

The above method of making a ground connection is simple, and has been found to give excellent results, and yet, if not made in proper soil, it will prove of little value. Where a mountain stream is conveniently near it is not uncommon to throw the ground plate into the bed of the stream. This, however, makes a poor ground connection, owing to the high resistance of the pure water and the rocky bottom of the stream. Clay, even when wet, rock, sand, gravel, dry earth and pure water are not suitable materials in which to bury the ground plate of a bank of lightning arresters. Rich soil is the best. It is therefore advisable, before installing a bank of choke coils and lightning arresters, to select the best possible site for the lightning arrester installation, with reference to a good ground connection. This may often be at some little distance from the station, in which case it is, of course, necessary to construct a lightning arrester house. Where permanent dampness cannot be reached it is recommended that water be supplied to the ground through a pipe from some convenient source.

When possible a direct connection to an underground pipe system especially of town or city water main furnishes a very excellent ground on account of the great surface in contact with the earth and the numerous alternative paths for the discharge. In a water-power plant the ground should always include a connection to the pipe line or penstock. Furthermore, as the effectiveness of the arrester is of great importance it should be inspected from time to time, and the resistances and earth connection tested for open circuit.

*Abstract of a paper read before the American Institute of Electrical Engineers.

VOLTAGE TESTS.

In view of complaints from different parts of the country with reference to the inadequate electric pressure supplied to incandescant lamps, the Department of Inland Revenue has called the attention of inspectors of electric light to the necessity for a more strict compliance, on the part of electric lighting companies, with the provisions of sec. 4 of the Electric Light Inspection Act. Inspectors are requested to make weekly tests of voltage in different parts of the cities or towns in which they reside, and as often as convenient in other parts of their districts. When the variation in voltage is found to exceed the limit allowed by law, the inspectors are to notify the contractors, in writing, of the fact, and request that the requirements of the Act be complied with.

For these weekly voltage tests the plugging on of the volt meter to lamp sockets at different points of the system will suffice ; but when formal demands for voltage tests are made by either of the parties concerned, the instructions given in the regulations must be followed. A report of the weekly voltage tests must accompany the monthly returns.

DEPRECIATION.

Business concerns, from the most modest shop to the largest railway and steamship companies, have gone into the hands of receivers from either the entire absence of, or improperly handled, depreciation account. That the subject is an intricate one, says Mr. L. S. Randolph in "Cassier's Magazine," can be readily shown by asking any given set of men what rate of depreciation should be allowed on a dynamo. One large steel works not long since built an enormous steel hammer. Three years later it was standing idle, being thrown out by the hydraulic press ; depreciation 33 per cent., the usual allowance being 3 per cent. Machines which ten years ago were the best on the market are superseded by those which will permit a competitor to double his output with half the labor ; the result is that the new machines must be purchased or the business abandoned. The whole list of the various elements of cost can be gone over in the same way and with the same result.

ELECTRIC RAILWAY CHARTERS.

At the recent session of the Ontario Legislature, the following companies obtained charters for the construction of electric roads : Durham Switch-Line Railway Company ; Huron and Bruce Railway Company ; Huron, Bruce and Grey Electric Railway Company ; Middlesex and Elgin Interurban Railway Company ; Morrisburg Electric Railway Company ; Ontario Electric Railway Company ; Peterborough Radial Railway Company ; Petrolea Railway Company ; South-Western Traction Company.

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1 25 light **Reliance Arc Dynamo** in first-class condition.
1 60-light **Royal Type Transformer**, 1040 volts to 110 newly re-wound.
3 10-light **Shellenberger Watt Meters.**
2 20-light **Duncan Watt eters.**
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SPARKS.

A by-law to raise $6,000 to establish an electric light plant at Tottenham, Ont., was carried by the ratepayers.

The Gladstone Electric Light & Telephone Company, of Gladstone, Man., is applying for incorporation.

It is the intention of the Canadian Pacific Railway to install a dynamo for lighting the shops, yards, etc., at Revelstoke, B. C.

The plant of the Bear River Electric Light, Heat & Power Company at Bear River, N. S., was recently slightly damaged by fire.

The Charlottetown Light & Power Company, of Charlottetown, P.E.I., have purchased a 400 h. p. engine for their new power house to be built this spring.

The American Cereal Company have just given a contract to the Canadian General Electric Company for a 1,000 h.p. generator and several motors and transformers.

At a meeting of the directors of The R. E. T. Pringle Company, Limited, Montreal, the following officers were elected for the ensuing year : Thomas Pringle, president ; Geo. C. Rough, vice-president and manager, Montreal ; R. E. T. Pringle, managing director and treasurer ; Irving H. Smith, manager St. John Branch ; George Leroux, secretary.

Messrs. C. D. Warren, Charles Ritchie, Robert Davies, A. H. Boyce, Hugh Sutherland and A. W. Ballantyne, of Toronto, are applying for incorporation as the Dominion Power Company. The intention is stated to be to secure power from the companies now developing at Niagara Falls and to transmit it to Toronto and other places. The capital is placed at $5,000,000.

An official of the Shawinigan Water & Power Company states that the rejection of the company's bill by the Quebec Legislature will have no effect on the general proposition of transmitting power to Montreal. He states that contracts have already been let for the greater portion of the material for the transmission line, which will follow the route of the Great Northern Railway as far as Jolliette, from that point pass over the right of way of the Chateaguay and Northern Railway to Bout de l'Ile and into the city on a straight line from that point. The works as now completed at Shawinigan Falls are capable of delivering in Montreal 10,000 horse power.

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ELECTRICAL REPAIRS

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have arranged their works for repair work only. They keep armatures of nearly all makes of dynamos in stock, which they loan while repairs are being made. Their factory is so arranged that they can run night and day, and work can be finished in the shortest possible time. **Telephone Main 3149.**

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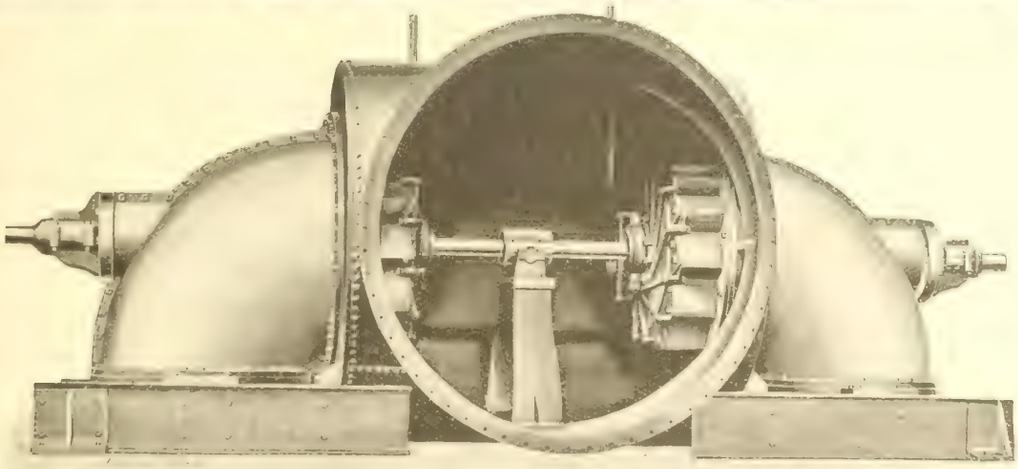
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CANADA.

SPARKS.

The town council of Milton, Ont., is negotiating for the purchase of the electric light plant.

The ratepayers of Gravenhurst, Ont., are to vote on a by-law to raise the sum of $15,000 to purchase the electric light plant.

DeWitt & MacKinley, electricians, Sydney, N. S., have dissolved, and have been succeeded by the DeWitt Electric Company.

The McLachlan-Joy Electric Company, Limited, has been incorporated, with capital stock of $37,000 and head office in Toronto.

The Inverness Electric Light, Heat & Power Company has asked the Nova Scotia Legislature for a charter. The head office will be at Port Hood.

A company is said to be in process of formation at Rat Portage, Ont., for the purpose of constructing an electric railway from that town to the English River, a distance of forty miles.

It is expected that tenders will shortly be invited for the construction of the second power canal of 50,000 horse power at Sault Ste. Marie, Ont. It is said that the Lake Superior Power Company have taken soundings and are now having plans prepared for the power house.

Mr. R. H. Martindale has resigned his position with the Alliston Electric Light Company to assume the management of the municipal electric light and water-works plant at Sudbury, Ont. Mr. Martindale is a young man of good ability, and if given a free hand will no doubt give the town of Sudbury satisfactory service.

A meeting of the Bear River Electric Light, Heat & Power Company was held at Digby, N. S., recently, at which a dividend of 8 per cent. was declared on the paid-up capital, and a substantial balance carried forward. The business of the past year made an excellent showing.

Mr. M. E. Davis, contractor, is reputed to be at the head of the new Provincial Light, Heat & Power Company which recently presented a bill to the Quebec Legislature for power to operate in the city of Montreal. The headquarters of the concern are to be at Three Rivers, and the first directors are Messrs. Allan MacDougal, H. J. Harrison, John Hyde and E. P. Ronayne.

The council of Toronto Junction, Ont., is still wrestling with the lighting question. The existing electric light plant is out of date and in need of renewing. The Humber Light and Power Company have agreed to supply a system of interior light and power for factories, stores and residences at ten cents per kilometer and to have their plant in operation before October. The franchise is not to be an exclusive one; but the council is debarred from running a competitive lighting system. The company also agrees to furnish power to operate the present arc plant.

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SPARKS.

The city of Winnipeg, Man., has decided to install its own fire alarm system.

Surveys are being made for the extension of the Sherbrooke Street Railway to Brompton Falls, Que.

The Canadian General Electric Company is the lowest tenderer for the supply of electric light carbons for the municipal plant at Victoria, B.C.

Mr. J. W. Easter, representing the Seguin Power Company, has made an offer to purchase the electric light plant at Parry Sound, Ont., from the town.

The Ontario legislature has transferred to the corporation of Fort William, Ont., the rights given to Mr. E. S. Jenison to develop the water power of the Kaministiquia river. The town must compensate Mr. Jenison for the work done and for the plans, etc.

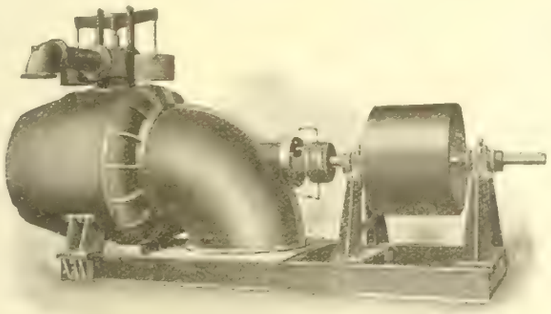
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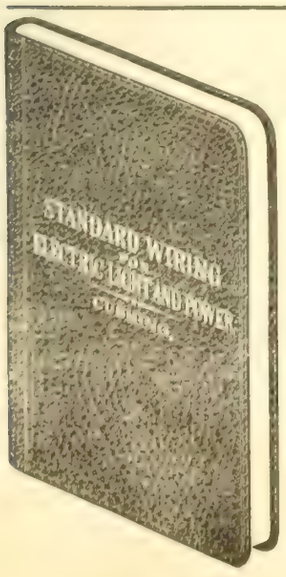
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SPARKS.

The Algoma Electrical Supply Company has commenced business at Port Arthur, Ont.

The Fraser Electric Company, Fredericton, N. B., is applying for incorporation.

A committee has been appointed by the city council of Berlin, Ont., to employ an expert to value the plant of the Berlin Gas & Electric Light Company with a view to purchase.

The Ottawa Car Company is now building several cars sixty feet six inches long for the Quebec and St. Anne de Beaupre division of the Quebec Railway. The company is also building fourteen cars for the street railway at Sydney, C. B.

The Hull water power, the ownership of which has been for some years the subject of litigation between the city of Hull, Que., and the Scott Estate, has been sold to the city by the Quebec Government.

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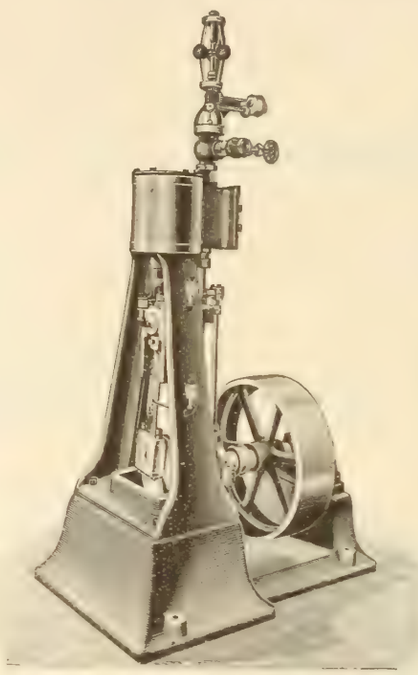
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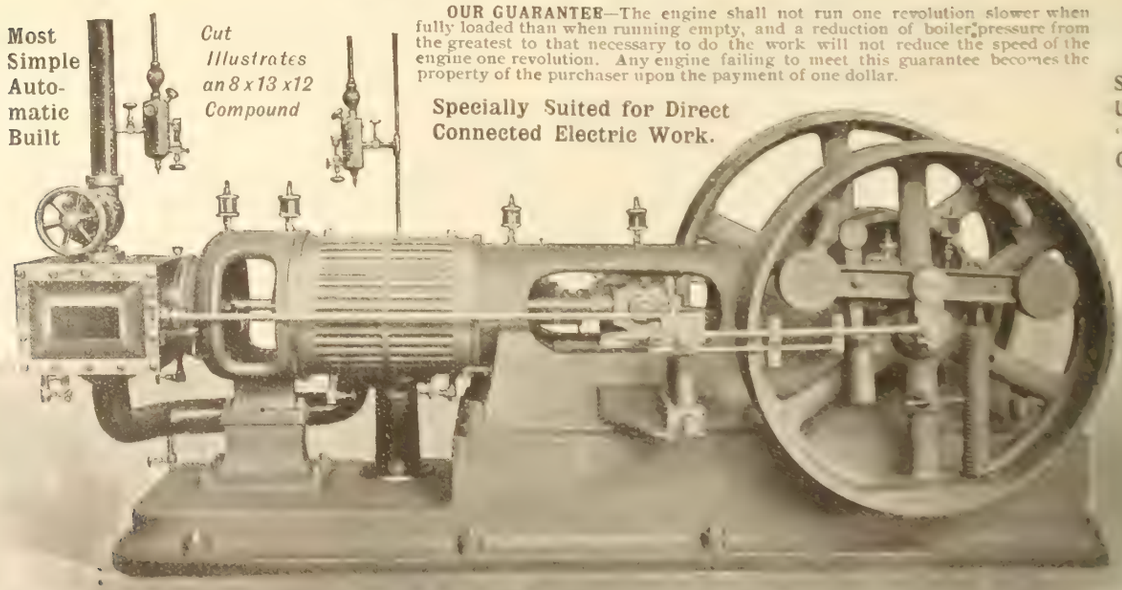
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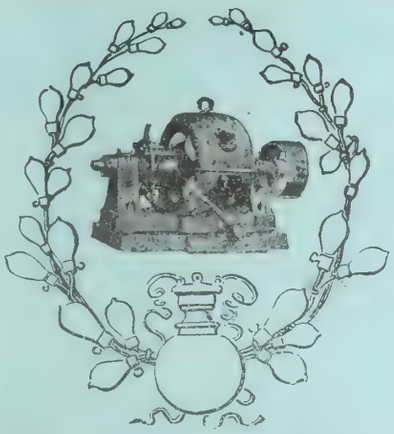
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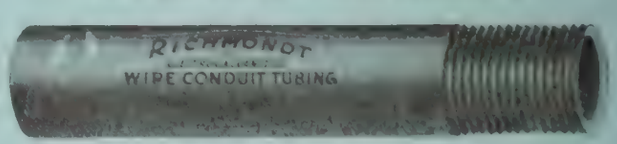
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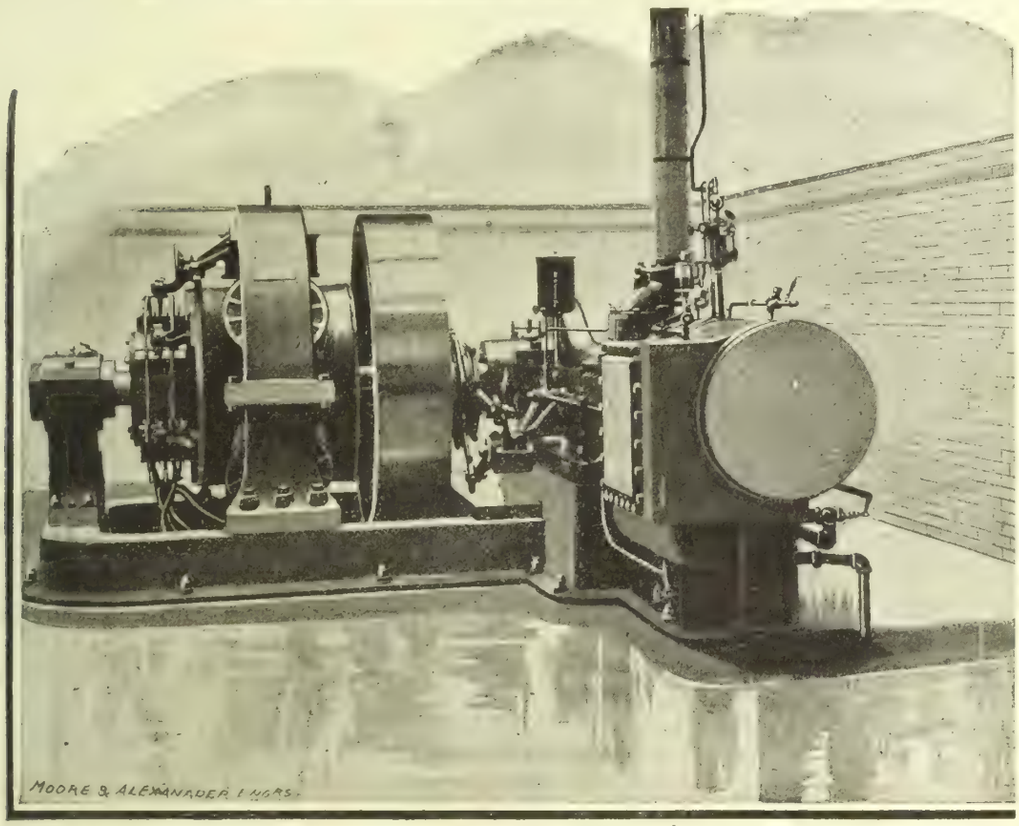
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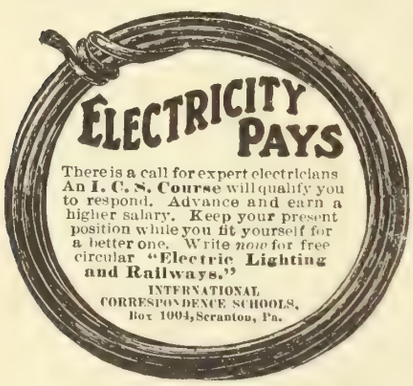


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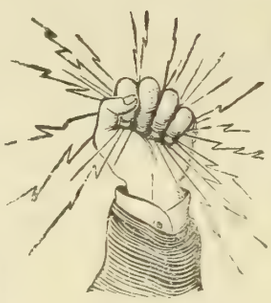
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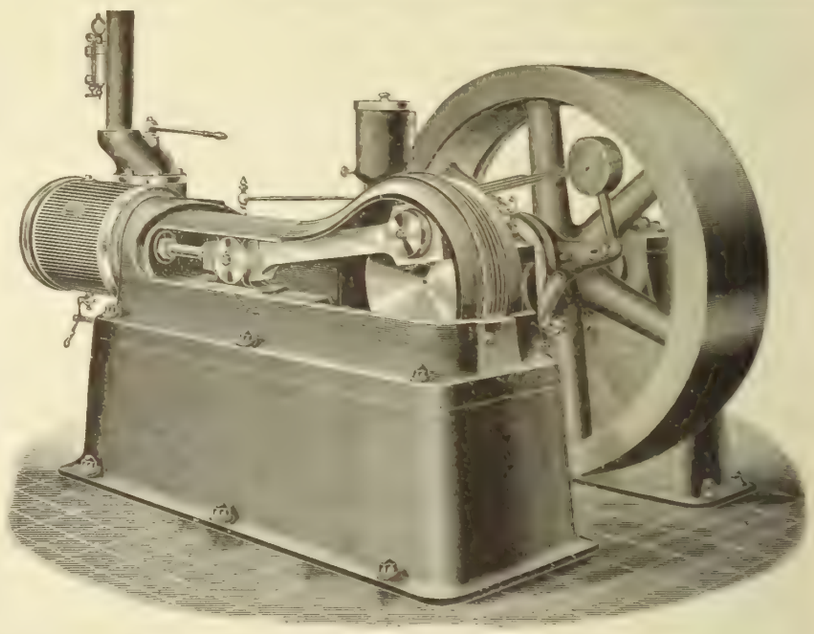
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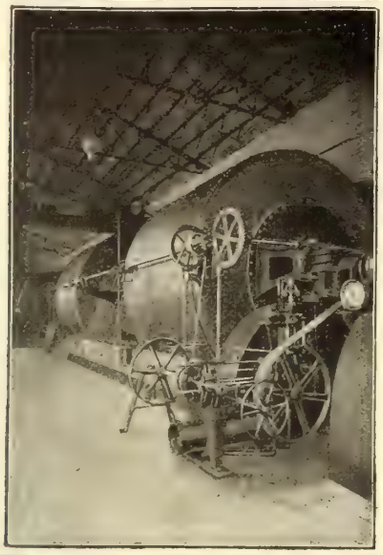
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WRITE FOR CATALOG. DEPARTMENT E.

PERSONAL.

Mr. C. T. Wilkinson has been appointed superintendent of light and power for the corporation of Brockville, Ont.

Prof. L. A. Herdt, E.E., of the electrical engineering department of McGill University, Montreal, has returned from a vacation in the United States.

Mr. William L. Gilchrist, chief electrician, and Mr. Charles Beardman, chief engineer for the city of New Westminster, B.C., have tendered their resignations.

Mr. Frederic Nichols, managing director of the Canadian General Electric Company, returned to Toronto recently after a six weeks trip through the Western States and British Columbia.

With a view of benefitting his health, Mr. M. J. Kennedy, superintendent of the Montreal Street Railway, accompanied by Mrs. Kennedy, left last month for a trip to England and France.

Mr. John Carroll, formerly manager of the Eugene F. Phillips Electrical Works at Montreal, is now the travelling representative of an American electrical supply firm, and was in Canada recently renewing old acquaintances and forming new ones.

Mr. L. A. Campbell, manager of the West Kootenay Power & Light Company, of Rossland, B.C., was in the east last month on business and renewing acquaintances. Mr. Campbell states that the demand for electric lighting and power in British Columbia is steadily growing.

Mr. Alex. Murray, of London, Ont., electrical inspector for the G. N. W. Telegraph Company, died almost instantly on April 17, while engaged in inspecting the wiring installation at the Ontario Agricultural College. Mr. Murray was about 35 years of age and had been in delicate health recently.

SPARKS.

A movement is on foot to form a joint stock company to develop a water power at Flesherton, Ont.

The Canadian General Electric Company is installing an electric light plant in the Payne mine in British Columbia.

The city of Montreal is asking for tenders for two power pumps of 5,000,000 imperial gallons capacity, to be operated by electricity.

A vote of the ratepayers of Fort William, Ont., will be taken on May 14 on a by-law to raise $12,500 for a telephone and fire alarm system.

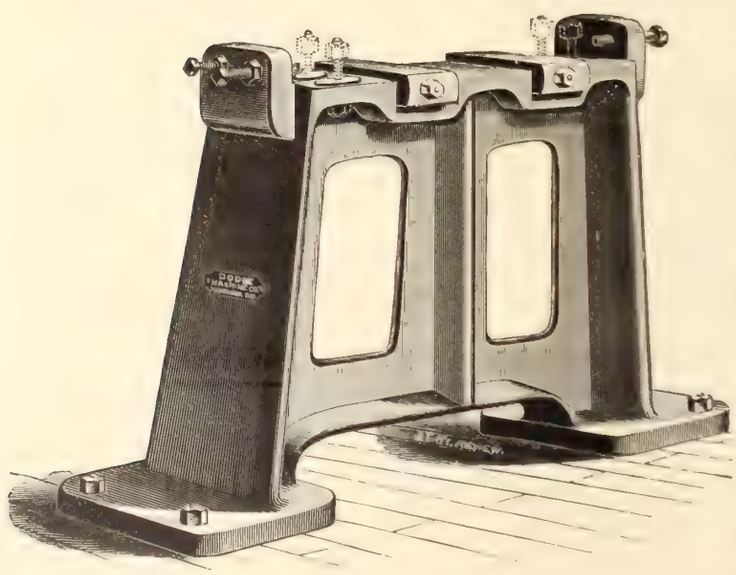
Mr. Buck, representing the Canadian General Electric Company, recently addressed the Hamilton City Council and advocated the substitution of electric for steam power at the sewage disposal works. He estimated the cost of electric plant at $5,500. A special committee was appointed to report on the proposition.

About two hundred employees of the Montreal Light, Heat & Power Company and the Lachine Rapids Hydraulic & Land Company, of Montreal, went on strike last month. The companies at first found themselves somewhat handicapped, as the strikers consisted of line-men, ground-men, trimmers and patrolmen, but succeeded in keeping the street lighting service in operation without serious interruption. A settlement was effected within a few days.

The development of 3,000 horse power on the Kettle river at Cascade, B. C., is nearing completion. The power is controlled by the London and British Columbia Gold Fields Company, of London, England. At Cascade the Kettle river rushes through a rocky gorge for a distance of half a mile, and has a natural fall of 120 feet. A dam 400 feet long and 50 feet high has been constructed at the head of this gorge which raises the water 36 feet above the natural level, thus giving a working head of 156 feet at low water. From the dam the water is to be conveyed to the power house, first by an open cut 223 feet long, thence through a tunnel through the solid rock a distance of 410 feet, thence by an open cut in the rock a distance of 500 feet; from this point, where a concrete bulkhead is being built, the water will be conveyed through a circular flume 12 feet in diameter to the power house. The power house is a fire-proof structure of stone and brick, 215x45, situated at the foot of the falls. The electrical apparatus will be installed by the Canadian General Electric Company, and there will be six turbine wheels of the horizontal type. It is expected that the maximum development will be about 9,000 horse power.

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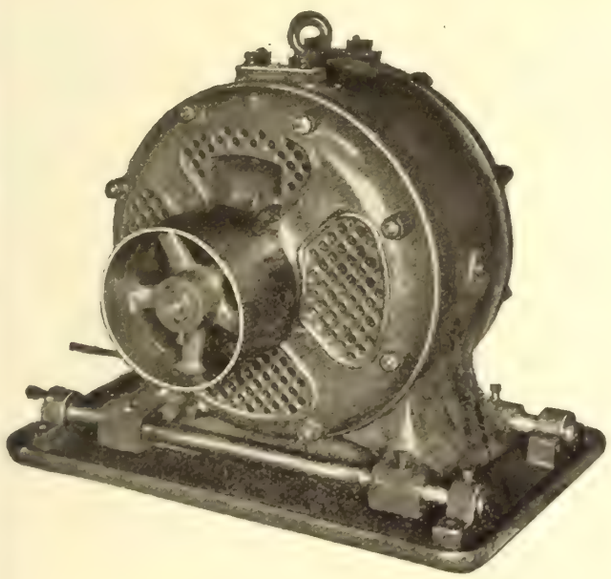
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SPARKS.

The Consolidated Electric Company, Toronto, has been incorporated, to acquire and carry on the business of the Dominion Electric Company.

The ratepayers of St. Mary's, Ont., will vote on a by-law on July 7th to raise $16,000 for extending and improving the waterworks and electric light systems.

Dr. A. Stansfield, Professor of Metallurgy in McGill University, Montreal, recently delivered a lecture before the Applied Science Society on "Electric Furnaces."

Messrs. Hyslop Bros., of Toronto, have secured the agency for Canada for the celebrated "Olds" motor vehicle, manufactured by the Olds Motor Works, of Detroit.

The street railway at Peterborough, Ont., was sold a fortnight ago to Detroit capitalists. The road has not been operated for some time, but the new owners will put it in first-class shape and build branch lines to Lakefield and Chemong Park. The National Construction Company, of Detroit, is said to be interested in the purchase.

Messrs. A. D. Dowd, G. E. Smith and G. E. Sleeper, of Boston, and John Carson, of Kingston, Ont., representing the capitalists interested in the construction of an electric railway between Toronto and Cornwall, have been investigating the prospects of securing right of way. They have intimated that the construction of the line would commence at Kingston and proceed westward. The company represents a capitalization of about $6,000,000.

The Jacques Cartier Water Power Company, of Quebec, who have secured the contract for city lighting, have placed an order with the Canadian General Electric Company for the necessary apparatus, including four 125 Brush arc machines, 400 latest type arc lamps, etc. The Bullock Electric Mfg. Co., of Cincinnati, have been given the contract for a portion of the required steam plant.

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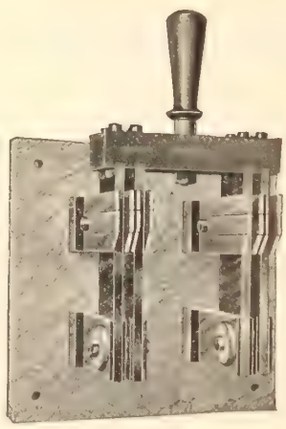
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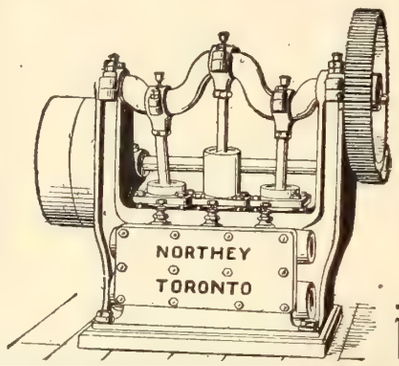
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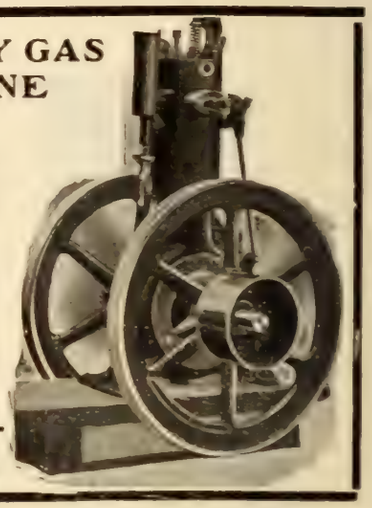


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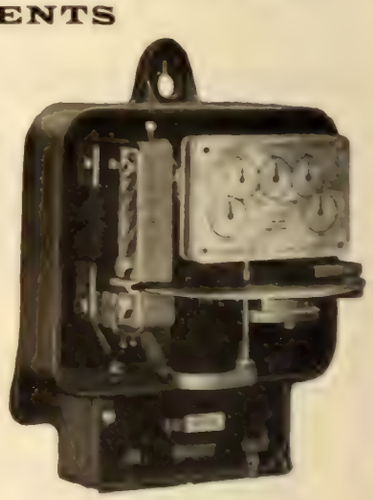
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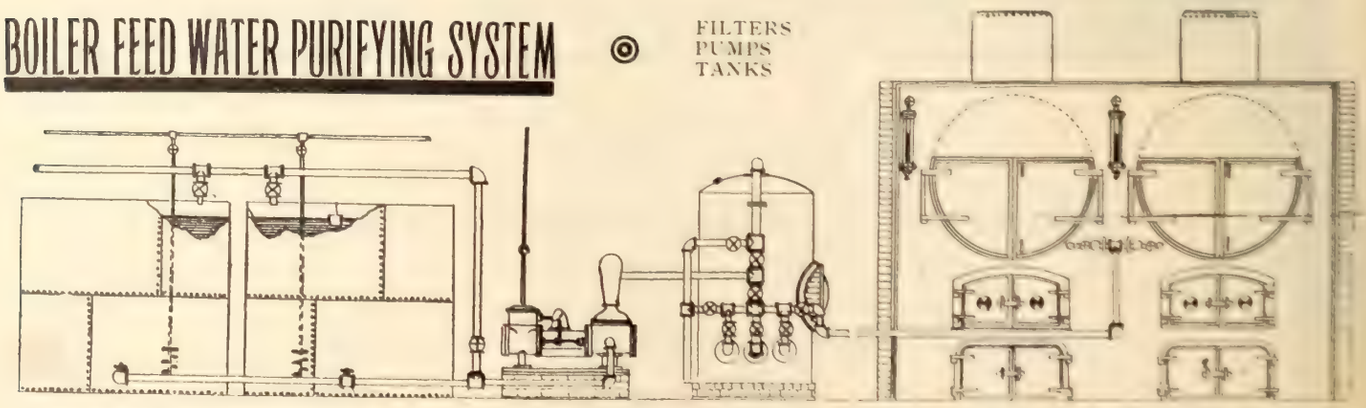
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CANADIAN
ELECTRICAL NEWS
AND
ENGINEERING JOURNAL

VOL. XII. MAY, 1902 No 5.

MR. J. C. M. BUNTZEN.

We introduce to our readers this month a gentleman whose attainments have placed him in the front rank among the managers of Canadian electrical companies. In Mr. J. C. M. Buntzen the British Columbia Electric Company have a manager of exceptional ability and energy, and one whose work has produced excellent results.

Mr. Buntzen was born at Copenhagen, Denmark, on December 16, 1859, and after completing a legal and mercantile education in Denmark, England and Canada, he became, in 1893, business manager of the Vancouver Electric Railway & Lighting Company. Two years later he was appointed secretary of the Consolidated Railway & Light Company in Vancouver. In April, 1897, he became associated with the British Columbia Electric Railway Company, and one year later was appointed to the position of general manager.



MR. J. C. M. BUNTZEN,
Manager British Columbia Electric Railway Company.

The British Columbia Electric Railway Company is composed of British capitalists, Mr. R. M. Horne-Payne being chairman. The company operate electric railways in the cities of Vancouver, Victoria and New Westminster, and also supply light and power in these cities. The company is operating 48 miles of electric railway and supplying light to 548 arc lamps and 68,878 incandesent lamps. Power is supplied to motors aggregating 1,000 horse power, divided amongst 149 customers. The whole system is being operated most satisfactorily and the demand for power has increased to such an extent that the development of a water power at Coquitlam Lake is under consideration.

The success of the company under Mr. Buntzen's mangement is best shown by figures. The number of electric lights supplied by the company increased from 19,015 on October 1st, 1897, to 68,878 at the close of 1901. The net earnings of the company in 1897 were about $50,000, while for 1901 they were over $200,000.

OPENING OF SOULANGES CANAL.

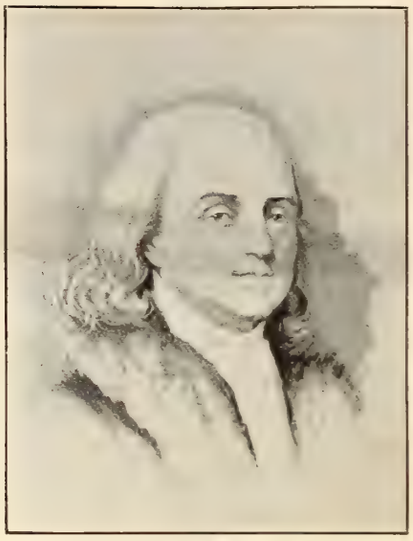
The Soulanges canal was opened for the season of 1902 on May 1st, with the new electrical apparatus for working the lock gates, sluices, bridges, etc., in full and successful operation. The locks are handled by two men, one on each side. The heavy gates (60 tons) are opened or shut in one minute, and the sluices in forty-five seconds. The machines work with perfect ease, safety and smoothness, and are designed so as to be under complete control and thus obviate any chance of break-down if handled with ordinary care. Only about half the number of men necessary to operate the canal by hand are now required — the money saving being nearly ten thousand dollars per annum. An ordinary lockage can be made in less than ten minutes, and a tug has been run through the whole fourteen miles and five locks in two hours and ten minutes. The canal is brilliantly lighted throughout, and is as easily navigable by night as by day. The entire power and light installation, design of motors, etc., is the work of the Canadian General Electric Company, of Toronto. It may be stated that this canal does not resemble in any way the details of either the "Soo," Welland, or the other St. Lawrence canals, and affords the best specimen of an artificial channel of fifteen feet draught hitherto constructed on this side of the Atlantic. The depth in the summit level, at mean stages of Lake St. Francis, is about seventeen feet, rendering it easily practicable to run its whole length of ten miles in about an hour without danger to the banks.

Messrs. F. H. Leonard, jr., of Montreal, and F. M. Campbell, of Kingston, have fixed the sum which the town of Rat Portage, Ont., shall pay to the Citizens' Electric & Telephone Company for their plant at $58,192. The town could have bought the plant some weeks ago for $55,000, but refused the offer and submitted the matter to arbitration, with the above result.



DR. WILLIAM GILBERT,

Died Nov. 30, 1603. Celebrated Physician and Natural Philosopher. Founder of the Sciences of Electricity and Magnetism.



BENJAMIN FRANKLIN,

Died 1790. Philosopher, Statesman, Diplomatist, Author and Inventor. Discoverer of relation between Lightning and Electricity.



COUNT ALESSANDRO VOLTA,

Died 1827. Celebrated Physicist. Inventor of the Electrophorus, the Electroscope, and the Voltaic Pile. The Unit of Electro-motive Force, the Volt, is named in his honor.



ANDRE MARIE AMPERE,

Died 1836. Celebrated Physicist and Mathematician. Renowned for his investigations in Electro-Dynamics. The Unit of Electric Current, the Ampere, is named in his honor.



GEORGE SIMON OHM,

Died 1854. Celebrated Mathematician and Physicist. Discoverer of Ohm's Law. The Unit of Electrical Resistance, the Ohm, is named in his honor.



MICHAEL FARADAY,

Died 1867. Celebrated Physicist and Chemist. Discoverer of Magnetic Rotation, Induction, Magnecrystallization, Polarization of Light, Diamagnetism, etc.



SAMUEL FINLEY BREESE MORSE,

Died 1872. Inventor of the Telegraph.



JAMES PRESCOTT JOULE,

Died 1889. Celebrated Experimental Physicist. Renowned for his Experimental Determination of the Mechanical Equivalent of Heat and the Law of Heating in the Electric Circuit.



SIR HUMPHREY DAVY,

Died 1829. Celebrated Chemist. Discoverer of the Electric Arc Light and Inventor of the Miner's Safety Lamp.

CELEBRATED ELECTRICIANS AND INVENTORS.

Reproduced by permission of the Electrical Engineer Institute of Correspondence Instruction, New York, from their Booklet. Can I Become an Electrical Engineer.

TESTS OF THE NERNST LAMP.

Mr. R. P. Hulse, in a paper read before the Birmingham Local Section of the British Institution of Electrical Engineers, gives the result of tests of the Nernst lamp as it is now put on the market. The tests comprised the measurement, on a direct-current circuit, of the life, candle power and watts, under the following conditions : Continuous run at normal pressure ; continuous run at pressures below and above normal ; continuous run with constant current ; continuous run with constant watts expended in rod ; test with varying volts (increasing until burner is destroyed) ; resistance test on the iron regulating resistance ; and heating effect of coil. The lamps were fitted with 100-watt 110-volt burners. The candle power was ascertained by comparison with standard Ediswan glow lamps, using an ordinary grease-pot photometer. The lamps were run with continuous current only, which was obtained from a battery of accumulators, by which a much more steady current was maintained than would have been possible with the mains, the excess volts when charging the battery being cut down by a regulating resistance. The average variation was less than half a volt.

All the lamps tested were protected by globes, and the results obtained from a ground-glass globe reduced to the clear-globe standard for comparison. The effect of removing the globe is to cool the luminous rod, increasing the resistance and diminishing the current by about one per cent. The run was continuous, only one break occurring in the circuit during the seven weeks, and that but for a few seconds.

The accompanying diagram (Fig 1) shows the behaviour and life of the Nernst lamp when run at constant pressure. Three lamps, each marked 100-watts 110-volts, were tested on 109.5 volts and a mean curve plotted from the three sets of curves obtained. These three were substantially the same, the large decrease (Fig. 2) and slight recovery being shown in each; and after this a steady diminution of candle power until 400 hours, the efficiency during this part also diminishing. After 400 hours there was another sudden drop, and then the state of the rod seemed to change, for there was a slight rise in efficiency and candle power up to the point where the burner broke. The table of life tests on normal voltage is as follows:—

LIFE TESTS ON NORMAL VOLTS (109.5).

Mean values from curves representing three separate tests.

Hours after start.	Current Amps.	Watts absorbed. Total in lamp	Watts absorbed. Per cent. on rod only.	Candle-power.	Watts per c. p. Total.	Watts per c. p. Rod only.	Resistance of rod. Ohms.
0	0·917	100·5	88·4	66·8	1·51	1·33	105·6
1	0·913	100·0	89·1	62·9	1·59	1·42	106·8
3	0·906	99·2	90·1	57·6	1·72	1·55	108·9
10	0·903	98·8	91·2	55·4	1·79	1·63	110·7
50	0·904	99·1	92·7	52·9	1·87	1·74	112·2
100	0·892	97·7	94·0	49·1	1·98	1·86	115·2
150	0·858	94·0	95·1	45·7	2·06	1·96	121·2
200	0·836	91·6	95·7	43·9	2·09	2·00	125·2
250	0·803	88·0	96·1	40·0	2·20	2·11	131·0
300	0·766	83·9	96·7	35·4	2·37	2·29	138·2
350	0·724	79·3	97·3	30·1	2·64	2·57	147·0
400	0·692	75·8	97·7	28·5	2·66	2·60	154·5
450	0·637	69.8	98·2	19·4	3·61	3·54	168·8
500	0·633	71·5	98.0	20·4	3·51	3·44	164·2

It will be noticed that the Nernst lamp begins by being abnormally good, but falls in efficiency by 20 per cent. or more in the first ten hours. Thenceforward it remains fairly normal almost to the end of its natural life, and then breaks up suddenly. There is a gradual fall in candle power during the normal run, but the watts fall also. Thus a 50-c.p. lamp starts off at 66-c.p. After 50 hours it is giving 53-c.p., and after 350 hours 30-c.p. The watts per candle are then 2.57, as against 1.74 watts per candle when the lamp was given 53 candles. The three lamps tested broke down after 509, 490 and 425 hours. The end comes in all cases by the breakage of the platinum contact at the positive end of the rod. It is evident immediately from the diagram that the lamps are done with in about 400 hours, but that a very fair economy is retained almost up to that point. This sudden breakdown seems to be the

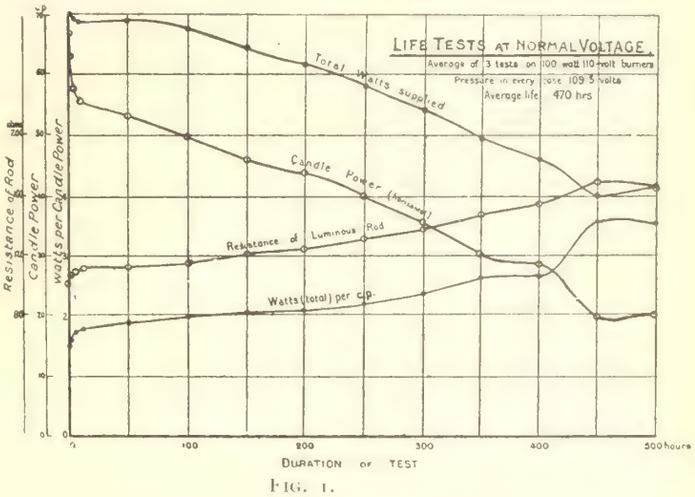


FIG. 1.

characteristic of the lamp. The natural life is very close to the 'economic life.' Therein it differs greatly from the glow lamp, which, if not removed, goes on running long after its efficiency has departed.

The author states that, assuming the cost per unit to be 6d., and that of the burner, fitting and depreciation of lamp and resistance as 3s., it is found by this method that it will pay to get a new burner at 350 hours; total cost being, up to that point, 19s.; candle-power-hours = 15,500 or 0.0147d. per candle-power-hour.

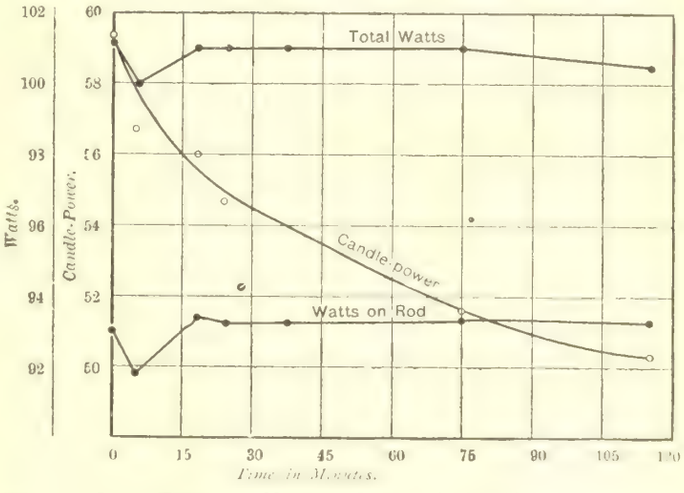


FIG. 2.—LIFE TEST ON NERNST LAMP. (109.5 VOLTS, 100 WATTS, 110-VOLT BURNER). FIRST TWO HOURS AFTER LIGHTING.

In conclusion the author makes the following summary:

The Nernst lamp will give on the average throughout a life of 400 hours at least ·48 c. p. per watt expended, as against not more than ·28 c.p. per watt in the case of good glow lamps. The cost of renewals would appear to be not more than three times as much for the Nernst as for the glow lamp, allowing for the shorter life of the former. In a 100-watt Nernst lamp the total energy used is over 35 units during economical life; and at 4d. a unit this costs 11s. 8d., or, say, not more than fifteen shillings when all expenditure due to renewal of the burner is taken into account. Thus the Nernst lamp will furnish 1,000 c.p.-hours at a cost of eleven pence; while fifteen pence is the approximate cost of the same amount of illumination from good glow lamps. In this comparative estimate the cost of renewals in each case has been included, the price per unit assumed to be 4d., while the glow lamp has been taken at an average of 3·6 watts per c.p. throughout a life of 700 hours.

CANADIAN ELECTRICAL NEWS AND ENGINEERING JOURNAL

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Door Keeper J. STRUSTHER,	Sarnia Ont.

The Export Trade. JUDGING by the difference in price between British and Canadian motors, there seems to be an excellent chance for Canadian manufacturers in this line to do a profitable export business. Indeed, the Americans appear to have already discovered the fact, and are taking advantage of it. It is said that in one year four hundred American motors were sold in Sheffield alone. This is not surprising, seeing that a 2 h. p. motor is listed by the British manufacturer at £29 odd, or about $150, less 10 per cent., while the Canadian manufacturer's price is only $60. Adding $10 for freight and selling charges, there would still remain a handsome margin of profit. At least one Canadian firm proposes to exploit the British market.

An Example of Municipal Management. JUDGING by the statement of a correspondent who has recently taken charge of a municipal plant in a town of 2,500 inhabitants in Ontario, municipal management, in this instance at least, has not proved a success. We quote as follows from our correspondent's letter: "The plant is a municipal one, and in this case has been a failure, as they have operated for some time at a loss. They have not always had a competent man, and their equipment has suffered, besides their plant is overloaded and a certain amount of business which could be obtained is consequently sacrificed. The power house is in bad shape through carelessness and mismanagement, consequently my hands have been full remedying, as far as possible, existing poor conditions. We shall probably shut down for a few days and have a general overhaul."

Canadian Electrical Association. IT is gratifying to learn that the arrangements for the Annual Convention of the Canadian Electrical Association, which will open in Quebec on June 11th, are making satisfactory progress. A number of valuable papers have already been arranged for. These will probably include a paper by Mr. P. H. Thomas, Expert for the Westinghouse Company of Pittsburg, on the subject of "Static and Disruptive Discharges," from Mr. C. M. Green, Lynn, Mass., and Mr. W. D. A. Ryan on "Arc Lighting Apparatus", and from Mr. A. B. Lambe, jr., of Toronto, on "Street Railway Apparatus." The various committees are at work, and it is expected that all arrangements will be completed within a month. The Secretary is in receipt of many applications for membership, and much interest is being taken in the approaching meeting, which promises to be one of unusual interest. Our June number will contain the full programme for the meeting.

Motors. ELECTRIC motors have lately come into use for such a variety of purposes that the demand is constantly increasing, and manufacturers of the better class of machines are so crowded with orders as to be unable to accumulate any stock. Buyers are coming to understand that there are other considerations than price which ought to govern the purchase of a motor—in other words that there are motors and motors. There is the motor put together so roughly that a lot of current is lost in the bearings, in another there is heavy loss in the field, others are subject to burn-outs due to careless and improper winding of the armature. On the other hand,

there are to be had motors so carefully designed and manufactured as to require the least possible expenditure for repairs, which operate smoothly and noiselessly and utilize all or nearly all the current supplied to them, in doing economically the work which they are set to perform.

Regulation of Railways.

A VOLUMINOUS report on railway commissions and railway rate grievances was presented to the Dominion Government last month by Prof. S. J. McLean, commissioner appointed for that purpose. Prof. McLean has evidently thoroughly investigated the question, and his report seems to confirm the contention that there is room for improvement in the regulation of railway rates and traffic. Acting upon his recommendation, Hon. Mr. Blair has introduced a bill in the Dominion Parliament providing for the appointment of a railway commission and to amend and consolidate the existing railway laws. The commission is to consist of three persons, one a lawyer of large experience and some knowledge of railway business, another an experienced railway man, and a third a man with large knowledge of general business. This board will replace the existing railway committee of the privy council, and in it is to be vested power to fix all traffic rates on railroads and lakes, rivers and canals. While the appointment of this commission is not likely to lead to the redress of all grievances, it is in accord with popular sentiment, and will probably result in securing more equitable rates for all classes and localities.

A School of Wireless Telegraphy.

THE success which has attended Mr. Marconi's invention, and the certainty that his system will immediately come into commercial use, has rendered it imperative that there should be available a considerable number of trained operators to take charge of installations on vessels and in the numerous stations which are about to be established in this and other countries. In order to meet this want, the Marconi Wireless Telegraph Company, of London, have established at Frinton-on-Sea, in Essex, a school for the training of students. As an inducement to students to take the course of instruction, the company pay a small premium, stipulating, however, that only those will be accepted who have passed through technical schools, or who show an aptitude for the work. The school is in charge of Mr. T. Bowden, who has been Mr. Marconi's assistant for a number of years. The buildings consist of two villa residences in which accommodation is provided for the students, who are required to sleep on the premises. The pupils are taught how to send and receive messages, and are thoroughly instructed regarding the mechanism of the various instruments. They are also taught how to make repairs, new parts, and to keep the instruments in proper working order. The period of instruction necessary, in the case of most students, is about four weeks. After a student has mastered the new alphabet and the technique of the instruments, he is put in charge of the Frinton station and held absolutely responsible for all messages received and answered. He is required to make out a daily report to the London office and reply to all enquiries.

Legal Matters Affecting Electrical Companies.

THE decision in the "scrap-iron" assessment case, given last month, is in favor of the electrical companies. The city of Toronto endeavored to take advantage of an amendment to the Assessment Act repealing the clause requiring that the real property of railway, telephone and electric light companies should be assessed in the wards in which it is situated. The city's contention was that the amendment did away with the scrap-iron clause and permitted the plants of these companies to be assessed as going concerns. The Court of County Judges held that the amendment to the act was merely an enabling clause to facilitate the work of the assessor. The Court of Appeal has upheld this judgment. The decision of the Courts regarding the purchase by the city of Kingston of the property of the Kingston Light, Heat & Power Company shows that when an electric lighting company enters into a specific agreement to dispose of its plant and franchise by arbitration, the clause of the law requiring that the city shall pay for the franchise a price equal to ten per cent. of the value thereof cannot be applied. The arbitrators decided that the franchise of the Kingston Company was worth $80,000, but that the city was not under any obligation to pay for it, owing to an agreement which gave the city the right to purchase the "works, plant, appliances and property" of the company at a price to be fixed by arbitration. This was the view taken by the courts. The decision is a warning to electrical companies to take every precaution in making contracts to provide against possible points of dispute.

ELECTRIC LIGHTING OF QUEBEC.

Two tenders were received by the city council of Quebec for electric lighting. There are at present 368 arc lights and 60 incandescent lights furnished to the city, the price being $80 and $25 per light per year. The tenders submitted were as follows: For arc lights, Quebec Railway, Light & Power Company, $69.80 per light per year for five year contract and $67.80 for ten year contract; Jacques Cartier Water Power Company, $54.00 for five or ten year contract. For incandescent lights, Quebec Railway, Light & Power Company, $25 per light per year for five or ten years; Jacques Cartier Water Power Company, $15 for five or ten years. Both companies tendered on the direct current system. The council has accepted the tender of the Jacques Cartier Water Power Company on a five year's contract. It is the intention of the company to immediately install a 1,800 h.p. reserve steam plant.

NATIONAL ELECTRIC LIGHT ASSOCIATION.

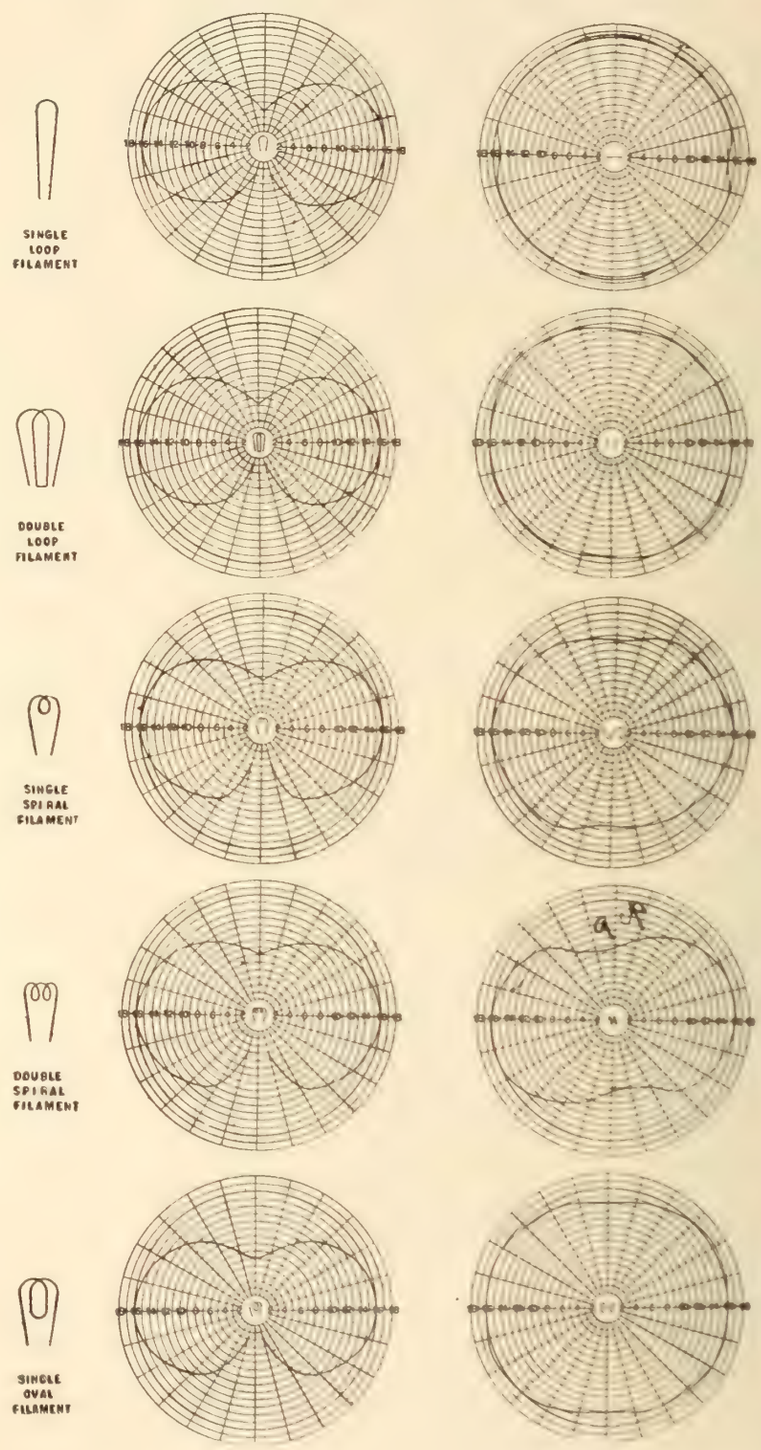
The annual convention of the National Electric Light Association of the United States is announced to be held at Cincinnati, Ohio, May 20-22. There has been a large increase in the membership of this association, and an interesting meeting is anticipated. The programme will include fewer technical papers than usual, but fifteen or twenty topics of practical interest to central stations have been selected and competent persons asked to prepare discussions upon them.

The Westinghouse Electric & Manufacturing Company has recently issued to the trade an attractive folder on Westinghouse lightning arresters. It contains an excellent description of the new Westinghouse low equivalent arrester, which has been received with such general favor.

A LAMP CATALOGUE.

Lamp users will doubtless appreciate the new lamp catalogue which has just been issued by the Packard Electric Company, of St. Catharines, Ont. It is of very attractive appearance and contains excellent illustrations of the standard types of Packard lamps. A distinctive feature of these lamps is the straight-sided or moulded bulb, now adopted by the leading lamp makers of the United States. Packard lamps are regularly made in efficiencies of 3, 3½ and 4 watts per candle. The company, in their catalogue, state that the lamps of 3 watts efficiency should only be used where the voltage is practically constant at all times ; lamps of 3½ watts efficiency may be used on circuits where the voltage varies approximately 2 per cent., and lamps of 4 watts efficiency are for use on circuits where the voltage is fluctuating.

By permission of the Packard Company, we reproduce herewith several curves illustrating the vertical and horizontal distribution of light of the various forms of filaments in common use. The concentric circles represent the candle power from 2 to 18. The left hand column shows vertical, the right hand horizontal distribution.



POWER EQUIPMENT OF THE GRANBY SMELTER.

The Granby Consolidated Mining, Smelting & Power Company, of Granby, B. C., is said to operate the largest copper smelting works in Canada. During last year 230,928 tons of ore were treated at the Granby plant, the capacity of which is being increased. The location is on the north fork of the Kettle river, where 1,200 horse power is developed at extreme low water under an actual head of forty-five feet. The dam, according to the Mining Record, gives about thirty feet of this head, the rest being made up between the dam and the power house. The dam is 175 feet across the top, 75 feet from heel to toe on the bottom, built out of 12x12 inch sawn timbers, filled in with rock and gravel. The flume is 12x9 feet and one mile long.

The power house is within 1,000 feet of the smelter buildings and 100 feet below them. The power for driving the blowers, sampling works, converter, etc., is created by three double sixteen inch turbine water wheels, connected with the flume by steel intake pipes 4 feet 7 inches in diameter. Each wheel is directly connected with one Westinghouse rotating arm, altemating current generator. Another wheel is belted to two pumps, each with a daily capacity of 750,000 gallons. These pumps furnish water and pressure to granulate the slag as it runs continuously from the furnace.

All the machinery is operated by Westinghouse induction motors. There is a 75 h. p. motor for sampling works, a 30 h.p- motor for matte sampler, a 25 h.p. motor for the machine shops, and a 10 h. p. motor for the elevator in the main furnace building. There are three blowers, each being driven by a 75 h.p. Westinghouse induction motor belted directly to the blower.

By the enlargement now nearing completion the power plant will be increased by a 250 h.p. horizontal turbine water wheel and a 250 h.p. generator directly connected to the water wheel, making a total of 250 h.p. developed for the use of the city of Grand Forks. Two additional triplex power pumps, which will each supply 750,000 gallons of water daily, are being installed by the Stillwell-Bierce & Smith-Vaile Company, of Dayton, Ohio. The electrical plant throughout was furnished and installed by the Westinghouse Electric & Manufacturing Company, of Pittsburg, Pa.

CORRESPONDENCE

CABLE-LAYING.

WILKES BARRE, Pa., April 18th., 1902.

Editor Canadian Electrical News:

DEAR SIR,—I received your newsy little paper to-day, and in looking over it I notice with regret the death of Mr. C. W. Lundy. I also saw that you mentioned the name of Siemens Bros. as being connected with the Great Eastern Atlantic Expedition, and I think you are in error. The company which did this work was Messrs. Glass, Elliott & Company, which afterwards became The Telegraph Construction and Maintenance Company, which company you mention on the next column as laying the Pacific cable. Siemens had nothing much to do with cable laying until somewhere along about 1874, and its first really unqualified success was the laying of the Commercial cables in 1883. As to the Telegraph Construction & Maintenance Company, they have laid possibly 75 per cent. of the submarine cable in existence.

Very truly yours,

E. W. STEVENSON,

Electrician Hazard Manufacturing Company.

A NEW EXPERIENCE.

SHERBROOKE, QUE., April 14th, 1902.

Editor Canadian Electrical News:

DEAR SIR,—We had rather a strange thing happen on one of our street light circuits on Sunday evening, April 13th. I must first explain that we are running the series alternating current arc lamps, as supplied by the Canadian General Electric Company. We run two circuits from our station, about nine miles each circuit, having 47 lamps on one and 45 lamps on the other. On the night I mention it was wet and blowing, had been so all day; the circuits had been tried several times for any open or ground lines, but no appearance of any when started.

The patrolman went out as usual, but came back and said quite a few of the lamps were out on the circuit with the 47 lamps. This circuit is carried over a river and back on the same poles, and along a side street and back to the same street which it left before crossing the river. On one end of the circuit near the station there were five lamps burning, then a ground came on owing to one of the wires to the lamp coming in contact with a guy wire; the next twenty-seven lamps were out, and on the same street where first ground was another ground was on with wires solid on a tree. This was 2,200 feet distant from first ground. All the lamps beyond that on the other end of the circuit were burning without the least flicker—fifteen lamps—and burned for an hour; they were put on and off several times to find if the ground would show. The lamps all started up at once when the first ground mentioned was taken off; the other ground was taken off next morning.

The controlling device in the transformers worked to perfection with the 27 lamps off. The attendant did not observe any difference on the ammeters. When the patrolman came in and reported, he went and examined the lever on the transformer and found it higher than usual. The ammeter showed the pointer at the red mark which we have on the dial, and no jumping.

This experience may not be anything new to many of your readers, but it is something we have not had on our lines previous to this. I wish to add a word of praise for this system of arc lighting, and would advise any company who may be contemplating a change in their street lighting to examine into the system as supplied by the Canadian General Electric Company of Toronto. They will find the lamps and transformers the simplest and most flexible (for controlling the current) that is in the market.

Yours truly,

A. SANGSTER,

Superintendent Sherbrooke Gas & Water Company.

THE FUTURE OF THE STEAM TURBINE.

From a paper on the future of the steam turbine, by Mr. W. E. Warrilow, in a recent issue of the Electrical Review, some interesting facts about the advantages of the steam turbine may be gathered.

Possessing but one rotating part and requiring no special foundation, it embodies all that could be desired for coupling to any type of dynamo for direct or alternating current. The improvments effected in its construction and its employment in a large number of electricity works in this or other countries should indicate that it is destined to fill a prominent place in the generating stations of the immediate future. Unlike the early undertakings, the schemes which are now planned demand units having capacities running into thousands of kilowatts, instead of hundreds, so that the class of engine which the turbine represents has every opportunity of appearing to the best advantage, as far as steam consumption is concerned. This question of consumption of steam in pounds per kilowatt has been a favorite one with consultants, the makers of engines being encouraged by the offer of a bonus to reduce it as much as possible. The guaranteed performance of a reciprocating engine in this respect has often given it the preference over such an engine as the turbine, though no calculation has been made as to the possibilities of either engine to get out of order, or increase its steam consumption with time.

An important feature of the steam turbine, not always considered, is the freedom from great or sudden angular variations in speed. This defect in reciprocating engines has been noticed at length elsewhere in these columns, and it is one which is of constantly increasing importance. With its high rotative speed, and entire absence of reciprocating parts, it is practically impossible for any appreciable variation in speed to occur in the course of a single revolution, the speed changes necessarily extending over a number of revolutions, and being gradual in their nature, while with the use of properly proportioned governors, even these gradual variations in speed may be kept within very narrow limits.

A modern turbo plant of 1,500 kilowatt capacity will stand on a floor space of 728 square feet, and will have its own condensing plant at that. No foundations are needed for its reception, and no oil is necessary for the lubrication of the rotating parts acted upon by steam. In both these items it will be at once seen that large economies in time and material will be effected, the absence of oil in the steam especially enabling the condensed water to be returned to the boilers. The machine when delivered can be assembled on its particular portion of the engine room floor, and no vibration will take place while the plant is in motion. The appearance of the engine room will also be greatly enhanced, in that the turbo sets occupy little head room, and consequently will cut off little or no light from the windows. The small vertical space needed also does much to decrease the cost of buildings as well as the steam and exhaust piping for the turbine. Combined with these are, the little attention required both for running and maintenance, and the ease of manipulation for parallel running on account of the even turning moment.

That the early types of turbine were extravagant in steam is well known, but this fault was due to the comparative scarcity of data in the design of such engines, as well as the fact that very small units were required for electric supply purposes.

The day of the small station is, however, about to depart, so that the turbo set can appear to its best advantage under the improved conditions, and where the reciprocating engine must ultimately fail, the turbine can be looked to as a reliable substitute. Such a fact is not one to cause regret on the part of engineers; rather should they welcome the new engine as a means of deliverance from the difficulties which progression on the present lines must assuredly bring. The existing state of competition in all industries, but especially the electrical one, will no doubt keep the reciprocating engine in our midst for some years to come, though the same competition will also bring more prominently to the front the steam turbine, even to the extent of finally ousting its rival.

LEGAL DECISIONS.

OTTAWA ELECTRIC COMPANY vs. F. X. ST. JACQUES.—Recently the Supreme Court gave a verdict to the Ottawa Electric Company against F. X. St. Jacques, proprietor of the Russell House in Ottawa, for breach of contract, the defendent having cut the wires of the plaintiff about December 1, 1897, although the contract did not expire until October 31, 1900. The Court directed the local Master-in-Chancery to fix damages, which he placed at $5,413. His decision is given below:—

The plaintiffs and defendant are agreed as to the general principle which should govern the assessing of the damages, namely, that the parties are as far as possible to be placed in the position they would have been in had the contract not been broken. I need not therefore discuss any of the numerous cases referred to in that connection on the argument.

But the parties differ widely as to how that principle should be applied to the facts of the present case.

The plaintiffs allege that with their total installation of 63,000 lights, necessitating the carrying of a variable "load" of, in the neighborhood, of 19,000, which would always bear overloading to a greater extent than 600, the cutting off of the Russell House lights had no effect in reducing their general expense. They point out that their machinery is driven almost exclusively by water power, and that the water flows on and the wheels go round and necessitate the presence of the staff whether or not the electricity is being used. They say that their smallest generator has a capacity of 1000 lights, and that even, therefore, had their "load" been reduced by the total number of lights in the Russell House, it would not have enabled them to throw out a single machine and in that way save anything in wages of employees. They allege that the only possible items of expense saved to them by the cutting off of the lights were (1) the cost of lamp renewals, which under the terms of the contract they were to supply, and (2) the additional coal which they would have burned in their auxiliary steam station during the portions of each year that it was in operation, assuming that all of the defendant's lights would have been supplied from there. Particulars of these deductions will be found at pages 11 and 12 of the printed case, subject to certain corrections appearing in Mr. Dion's evidence on the reference, (pages 53 and 54). They amount altogether, according to the plaintiffs, to $1321.31, which sum, deducted from the $11,666.66 which they would have received under the terms of the contract, would make the damages calculated in this way, $10,345.35.

The defendant, on the other hand, contends that the true method of getting at the plaintiffs' loss is by taking their total revenue for the period in question, plus the $11,666.66 which they should have received under the contract, and deducting therefrom the total expenditure, including interests on loans, plus an allowance to represent depreciation of plant, to get the true profit; when, as he argues, the loss will be a sum bearing the same proportion to what would have been received under the contract as the total profit does to the total receipts. This method is worked out in Exhibit 12 and results in fixing on the total sum of $185.30 as the amount of the plaintiff's damages.

In addition to these, two other methods are suggested, which I will have occasion to examine later.

The plaintiffs cite, in support of their contention, the case of Boyd v Queen, a decision of Mr. Justice Henry, sitting as a Judge of the Exchequer Court, reported in 1 Exchequer Court (Canada) at page 186. The defendant, on the other hand, relies on Woodburn v The Queen, decided by Mr. Justice Burbidge and reported in 6 Exchequer Reports (Canada) at page 12. Both were suits for damages due to the giving to outside parties by the Dominion Government of work which should have gone to the suppliants uuder their respective contracts. The defendant's counsel seemed to assume that the decisions were in conflict, but they do not appear to me to be so. The facts in the two cases, or perhaps the views respectively taken of them by the two learned judges, differed, but the same principle underlies both decisions. In the Boyd case the items sought to be deducted from the contract price were additional superintendence; and a proportionate amount for depreciation of plant, rent and depreciation of buildings, insurance on buildings, machinery, fuel and taxes and water rates. Mr. Justice Henry held that had Mortimer actually done the work in question he would not have had to pay out anything more under any of the several heads than he had in fact paid out in carrying on his ordinary business, and he disallowed the items. In the Woodburn case the contention was that no amount should be deducted to represent the wages that would have been paid out for the performing of the work, the suppliant alleging that he had staff enough to have done all of the work in question in addition to his regular work, and that, had he done it, he would have been at no extra expense for wages. Mr. Justice Burbidge says regarding this contention:

"I do not believe it to be possible that the additional work in this case could have been done without any extra cost for labor, if the work sent to the suppliant and executed by him had been done in a prudent and careful business manner."

To my mind this judgment of Mr. Burbidge assumes what Mr. Justice Henry in the other case expressly decides, that in getting at the damages in a case of this kind, the only deductions which should properly be made from the contract price, are amounts which the party would have actually had to pay out had he performed the work. This is the principle contended for by the plaintiffs and to my mind it is the true one, for in that way alone can an amount be arrived at which will place the party in the same position as if the contract had never been broken.

Such being the case, are the plaintiffs right in contending that the only extra expense they would have been put to had the contract been carried out would have been the cost of lamp renewals and of the extra coal that would have been burned at their steam station? I do not think so. Suppose that from the beginning to the end of the period in question their total installation, their average load, their working expenses, and their business generally had remained absolutely the same; suppose they had added no machinery and made no other alterations in or additions to their plant, and that the cutting off of the Russell House lights did not enable them to throw out a single generator and thus save anything either in wages or wear and tear. Under such circumstances I quite agree that in arriving at the damages the only items to be deducted would be those they contend for. But the facts are far otherwise. Instead of being at a standstill the plaintiff's business was a rapidly increasing one. Taking their annual statements for 1898 and 1901 respectively, (put in as Exhibits 4 and 5) it will be seen that in the three intervening years their total revenue increased from $159,583 54 to $196,363.-22; their total expenses from $109,117.61 to $160,379.86; the value of their assets from $1,249,636.21 to $1,551,247.67, and their total installation of incandescent lights from 63,113 to 93,-207. How can it be said in the face of these figures, that the cutting off of 600 or 750 lights made no difference in their expenses, other than under the two hears mentioned? It doubtless had no recognizable effect, in so far as the Company was concerned, but it certainly had some effect—an effect which I am bound to endeavor to measure. The proverbial "drop in the bucket" may have no appreciable effect on the amount of water therein, but every added drop hastens the moment when the filling of the vessel necessitates the replacing of it by another. Take the case of the Company's generators and suppose that for every 2000 lights added to the total installation a new generator must be put in. The addition of 600 lights, even though they themselves may still be carried on the existing machines, brings the Company that much nearer to the time when the new generator must be put in; and, conversely, the cutting off of 600 lights postpones to a like extent that day. It is said that a variable load of only about one-third of the installation is carried and that the machinery will always bear overloading to a greater extent than 600 or 750 lights; but this, to my mind, does not affect the question. It is clear that the load must bear a proportion, variable perhaps, but variable within fixed limits, to the total installation. The load carried in 1901 must be greater than that carried in 1898 in proportion, or at all events, roughly in proportion, to the difference in the installation. It follows from this that every change in the installation by the additional or substraction, not alone of 600 lights, but even one single light, has an effect, though perhaps an extremely slight effect, on the total load carried, and consequently, on the number of generators in use and the cost of running them. The same argument applies to all of the various items of expense and I think proves conclusively that in order to arrive at the amount which the plaintiffs would have been in pocket had the contract been carried out, the deductions from the contract price should by no means be limited to the two items of expense suggested by them.

How, then, of the method suggested by the defendant? It is open to the obvious and, I think, fatal objection that it assumes all of the Company's contracts to have been equally profitable. Suppose the Company's business in general was being carried on at a loss, but that the present contract was entered into at a figure which made it profitable. According to this mode of calculation there would be no damages—the balance might in fact be largely the other way. The possibility of such a result shows the unreliability of the method.

Two alternative calculations, based on the supposed cost per light, are put in, one on behalf of the plaintifts by Mr. Dion (Exhibit 2) and the other on behalf of the defendants by Mr. R.A. Ross (Exhibit 11). Mr. Dion's calculation is a working out of the following proportion:—The average maximum load carried is to the total year's expenses as the number of the lights in question is to the proportion of those expenses attributable to those lights. Mr. Ross' formula is somewhat similar but is based on what be considers to have been the average daily lamp hours.

Before proceeding to deal with these calculations it will be necessary to dispose of three preliminary questions much debated on the argument. The first of these is as to whether or not sums paid out by the Company as interest on debentures and other loans to them should be included in the expenses, the proper proportion of which must, according to either method, be deducted from the contract price in arriving at the profit which the plaintiffs have lost by reason of the defendant's breach of contract. I think clearly not. It is admitted that dividends should not be included and interest appears to me to be on much the same footing. Take the following illustration: Suppose two men are carrying on the same business side by side under precisely similar conditions and with the same amount of capital invested —say $10,000, the only difference is that whereas "A" has furnished his own $10,000, "B" has only furnished $5,000, borrowing the other $5,000 from a bank at 6%. Could it be said that the cost of manufacturing the articles was greater in the case of "B" than in that of "A"? Suppose, furthur, that "B" might have advanced the additional $5,000 out of his own funds but preferred to leave it invested at say 8 per cent. and to borrow the amount at 6 per cent., thus saving 2 per cent. The whole arrangement is, suppose, a more advantageous one to "B" than "A's" is to him. In the event of assessments of damages by the two manufacturers similar to the one as we are now dealing with, could it be said that "A's" loss was greater than "B's"? The proposition has only to be stated for the absurdity of it be

appear. Leaving out of the question the $300 that "B" pays to bank for interest—by which arrangement he nets $120 more than, on the supposition, "A" does—both men lose exactly the same amount per article by reason of the non-fulfillment of the respective contracts. Clearly "B's" loss cannot be less than "A's." I think the key to the situation is to be found in the distinction drawn by one of the witnesses between the gross profits of a business and the net profits. The former is the difference between the actual cost of manufacture (including of course marketing) and the selling price ; the latter is the amount which eventually reaches the pockets of the shareholders or manufacturer. Interest paid on money expended on plant, while it certainly affects the net profits, is not to be considered in calculating the gross profits, and it is with them that we have to do here.

The second question is as to depreciation of plant, the defendant contending that in calculating the plaintiffs' profits, and conversely the cost of producing light, a percentage should be written off under that head. It is not the custom of the plaintiffs to write off anything in their books for depreciation. A rest account is maintained which serves the same purpose. Moreover, the Company's plant is by constant repairs and renewals maintained in a high state of efficiency. It is also being constantly enlarged, renewed and added to, expenses of this character being charged to capital account. The company also point out that their water privileges and their franchise are always increasing in value and they say that this is of itself sufficient to offset any depreciation in the value of their plant. It seems to me that depreciation of plant, whether due to wear and tear or to what has been called "novation," is in a position somewhat analagous to that of interest. It is a question of impairment of capital. Plant is capital, and while an amount to offset its depreciation may very properly be deducted before ascertaining the net profits, it does not appear to me to affect the gross profits. Moreover, where one portion of the plant is increasing in value to an amount equal to or greater than the depreciation of the balance, the total value of the plant is not decreasing and it may be unnecessary to make any deduction for depreciation even in the net profits. The question is by no means free from doubt, but on the whole I think I would make no deduction under this head either.

The third preliminary question which it is necessary to determine is, what number of lights would the plaintiffs have had to maintain during the period in question had they continued to light the defendant's premises under the contract. The calculations of the plaintiffs are based on 600, though it was argued for them that the number should be only 549. The defendant's calculations, on the other hand, suppose 750, though evidence is given on his behalf of their being as many as 789 covered by the contract at the time of the cutting of the wires. The contract which will be found at page 36 of the printed appeal book was for all the "electric incandescent lights on the premises at present occupied by (the defendant), being the Russell House on Sparks street, Ottawa," subject to the following exception : "It is understood that the lights in the dining room, rotunda and kitchen are not included in this contract." The most important evidence as to the number of lights in operation at the time of the breach, is that of Louis Charbonneau, a porter in the hotel, whose duty it was to look after the lamps, repairing them when out of order and putting up new ones when necessary. His count, the result of which is contained in Exhibits 12 and 14, shows 789 lights exclusive of those in the rotunda, dining room and kitchen, made up of 240 on the ground floor and in the basement, and 549 in the upper halls and bedrooms. The latter figures are admitted to be correct, but the plaintiffs contend that it was never intended that they should light, under this contract, any portion of the hotel below the bedroom flats. There is no warrant for this in the agreement and I cannot so hold. The plaintiffs were bound to light the whole hotel, other than the dining room, rotunda and kitchen, and I cannot accede to their contention that pantries, servant's quarters, etc., are included in term "kitchen." There are, however, some lights shown in Exhibit 13, such as those in the cigar store and billiard room, which Mr. Street says were always paid for separately. These two portions of the hotel were sub-let and possibly the parties agreed that they were not, properly speaking, part of the hotel. Mr. Street produced an account for 132 extra lights, rendered to the defendant on February 11th, 1898 (Exhibit 16). Of these, four in the dining room and forty-six in the rotunda are not in question, reducing the number to 82. It will be noted that the account was not rendered untill sometime after the present dispute arose, and although amounting to $280.75 it was settled at $125. It would not therefore be safe to place too much reliance on it as a piece of evidence. Deducting all lights which can on the evidence fairly be deducted from those included in Exhibit 13, there still remain considerably over 700 which I think I should find were being operated under the contract at the time of the breach. There is another consideration which appears to be material. The agreement did not limit the number of lights and Charbonneau says he was in the habit of putting in additional ones whenever required. It would seem therefore highly probable that had the plaintiffs continued to light the hotel for the period in question the number of lights would have continued to increase as they evidently had previously been increasing, and this, quite apart from lights installed in new portions of the hotel, which it might have been contended could not fairly have been included in the lighting the plaintiffs had contracted to do. On the whole I think it a reasonable conclusion that the plaintiffs, had they continued to light the defendant's premises under their contract, would have had to maintain on an average in the neighborhood of 750 lights, and I shall, I think, be coming as near as practicable to the true facts if I find the number on which the calculation of the damage should be based, to be 750 as contended by the defendant.

Returning to the calculations set forth respectively in Exhibits 2 and 11, of the charges for interest and depreciation are dropped from the latter and the former is put on a basis of 750 lights, they are found not to differ very materially from each other. In fact, Mr. Ross arrives at a result more favorable to the plaintiffs than does Mr. Dion. If I have rightly understood it, the attitude of the Company with regard to the calculation in Exhibit 2 is as follows : They of course contend that the true mode of assessing the damages is that followed in the particulars at pages 11 and 12 of the printed case. If, however, the cost per light is, contrary to their contention, to be taken as a basis, then they say the damages should be arrived at in the manner indicated in Exhibit 2. I have already found that the plaintiff's original contention is not supported by the evidence. The method suggested by the defendant being equally faulty, the only remaining basis for the calculation of damages would seem to be the cost per light. On that basis I must say I think the mode of calculation adopted in Exhibit 2 is most liberal to the defendent. It will be seen that Mr. Dion has treated the matter as though the whole of the Russell House lights were burning at the times when the maximum loads were recorded. I cannot help thinking that this was at first an oversight, but when giving his evidence Mr. Dion said he was in this way allowing for any loss on the lines (questions 208-209) or any possible mistakes in approximations (questions 238-246). His opinion was that not more than 400 out of 600 lights would probably be burning at once, but in view of Charbonneau's evidence I should say, taking the whole year round, 400 would be decidedly an outside figure. Mr. R. A. Ross, it is true, stated that lights paid for on "flat" rates were always treated as "load," or, in other words, it was assumed that, the cost not depending on the hours of burning, such lights would be kept burning for at least a portion of every night. There is doubtless some modicum of truth in this, but on the evidence it was clearly not true of the Russell House lights. In the result, however, both Mr. Dion and Mr. R. A. Ross agree in treating the whole Russell House installation as "load," though they give different reasons for doing so. It will be found, on figuring out, that the average maximum load of incandescent lights in the first year in question stood to the Company's total installation of incandescent lamps in the ratio of 1 to 3.377, and Mr. Dion in working out his calculation might well have assumed to take 1/3.377 of the Russell House lights instead of the total number. There could have been no question of loss on the lines, since the proportion is between the total average maximum load and the total installation. And, as regards possible mistakes in approximations, they appear to me as likely to work in favor of as against the defendant. On the other hand, the calculation would have been based on the assumption that the defendants lights would have been burned on the same average as all other lights installed, including those paid for at meter rates, an assumption no doubt too favorable to the plaintiffs. I have myself taken the trouble to work out the cost per light on this basis, the following being my figures :

Taking the first year, 1897-98, the total installation of incandescent lights was 63,113. The Company, however, also supplied arc lights and motor power, and as expenses were not kept separately it is necessary to take account of them. Mr. Dion has given us the equivalent to these incandescent lamps as being, taking the average, 5,500 and 3,190 respectively, but these figures represent loads, and must be increased to represent installation. The average maximum load for incandescent lights in that year, based on the figures in Exhibit 2, was 18,690. Carrying the calculation to the third decimal, this is, as I have said, 1/3.377 of the installation. Multiplying 8,690, the sum of 5,500 and 3,190 by 3.377 gives 29,346 as the installation that would be represented by the arc lights and motors. This added to the 63,113 gives the equivalent of an installation of 92,459 in that year. The total expenses of the year, after deducting interest, were $84,186.16, but as the period in question included only five months of that year, we must take five-twelfths of that sum or $35,077.57. Dividing this by 92,459, the total installation gives .37926 as the cost per light for that portion of that year, or for 750 lights, $284.45.

In the second year, 1898-99, the total installation of incandescent lights was 77,255, and the average maximum loads for arc lights and motors were 5,500 and 3,975 respectively, or a total of 9,475. Assuming that the ratio of load to installation remained about the same as in the previous year, and multiplying the 9,475 by 3.377, we get 31,997 as the equivalent in incandescent lamps installed, of the arc lights and motors, or a total installation of 109,252 incandescent lamps. Dividing this into $91,298.00, the total expenses exclusive of interest, gives a cost of .83566 per light, or $626.75 for the 750 lights.

In the third year, 1899-1900, the total installation of incandescent lights was 87,114 and the average maximum loads for arc lights and motors were 5500 and 4625 respectively, or a total of 10,125. Multiplying this again by 3.377 gives 34,192 as the equivalent in incandescent lamps installed of the arc lights and motors, or a total installation of 121,336. Dividing this into $100,518, the total expenses exclusive of interest gives a cost of .82842 cents per light or $621.32 for 750 lights.

In the fourth year I do not appear to have the figures for the maximum loads, but the total installation of incandescent lamps was 93,207, and assuming that the equivalent in installation of incandescent lamps of the arc lamps and motors increased this year in the same ratio as in the previous year, the figures for them would be 34,648, making a total installation of 127,855. The

total expenses for the year were $133,867.80 (See Exhibit 6), and taking six-twelfth of this, or $66933.90, and dividing into it the total installation, we get .52438 as the cost per light for the first six months of the year or $393.29 for 750 lights.

Summing up the cost, if this method of calculation were correct, would be :

1st five months	$284.45
2nd year	626.75
3rd year	621.32
Last six months	393.29
	$1925.81

Deducting this from the contract price of $11,666 would leave the loss $9740.19. No doubt, as I have said, this method is too favorable to the plaintiffs, based as it is on the assumption that the Russell House lights were not kept lighted any more than the average of lights installed, including those paid at meter rates, but on the other hand, Exhibit 2 undoubtedly errs in the other direction.

The truth is that without further data which is not before me, and in fact is not available, it is impossible to arrive at a really accurate result. However, as the plaintiffs, if the cost per light must be taken as a basis, are satisfied with the method of arriving at it employed in Exhibit 2, I do not see that I can do better than adopt it. Mr. Dion makes the damages calculated in this way $6,664 for 600 lights. For 750 lights this would mean $5,413 and at that figure I assess the plaintiff's damages.

It will be seen that in adopting these figures I am largely influenced by the fact that they are the result of the Company's own calculation. If it were necessary to make any material alteration in the basis of that calculation—if for instance I felt bound to add to the expenses the amounts paid for interest and a percentage on the value of the plant by way of depreciation—I would not in that event deem it fair to hold the Company in other respects to their figures. Mr. Dion has allowed a liberal margin, perhaps enough even to cover interest and depreciation. Taking $1925.81, the cost of the lights on the basis of my own tentative figuring, and adding to it $626.46 and $1432.84, which are the total charges for interest and for depreciation respectively, according to Mr. Ross' figures, as corrected by Mr. Street (ppl 44 and 145 qq 20 and 22), on the basis of treating the Russell House lights as installation instead of load, we get a total of $3985.11, which deducted from the contract price would leave the damages $7680.89, a sum greater than the amount at which I am fixing them. As I have said, this method is too favorable to the plaintiffs. On the other hand, in Exhibit 2, the Company have been, as I think, unnecessarily liberal to the defendant, and as I have said, were I obliged to make allowances for interest and depreciation, I should deem it unfair to hold them to their figures and should feel bound to search for some other and more equitable basis of calculation.

Re. City of Toronto Assessment Appeals.—Judgment (R) on appeal by the city corporation from a decision of the County Judges of York, Halton and Ontario, upon the question of the assessment of the Bell Telephone Company, the Toronto Electric Light Company, the Toronto Railway Company and the Toronto Incandescent Light Company, in respect of their assessments for plant, including wires, poles, etc. The Board of County Court Judges reduced the assessments as confirmed by the Court of Revision. The question upon the appeal was whether the Board of Judges were right in deciding that the act 1 Edw. VII, ch. 29, sec. 2 (O), made no difference in the mode of valuing the rails, poles, wires and other plant belonging to the companies, erected or placed upon the highways, which was held to be proper by the decision in re Bell Telephone Company and City of Hamilton, 25 A. R. 351, and re London Street R. W. Company. Held, Maclennan, J. A., dissenting, that the Board of Judges were right in so deciding. Per Osler, J. A. :—The new clause does no more than enable the assessor to assess their property all together in one ward, or to apportion the assessment among two or more of the wards, as he may deem it convenient. It merely removes one of the difficulties pointed out in the cases before decided, but does not extend the principle on which the value of such property, apart from the franchise of the company or its use to a going concern, is to be ascertained by the application of the rule provided by sec. 28 of the assessment act for ascertaining its value. It is now to be valued as if it were all in one ward. That is to say, as a whole or as an intergral part of a whole, but still without reference to its connection with a franchise or its use as the property of a going concern. The learned Chairman of the board (McDougall, Co. J.) has given a very full and satisfactory exposition of the new section, to which nothing can be added,except that the decisions by which the Court of Appeal is bound require much more comprehensive legislation to remove their effect than anything which is found in that clause. Per Maclenna, J. A. (dissenting.) The injunction to assess all property at its actual cash value still remains. So does the mode of appraisement as if in payment of a just debt from a solvent debtor. But the obligation to assess in several wards is swept away, and it may be assessed all together in any one ward, or it may be apportioned amongst two or more wards, and in either case it shall be valued as a whole, or as an integral part of a whole. Each of the companies owns, and is assessed for, freehold land in the ordinary sense, as well as for their rails, poles, wires, etc., upon the public streets, and the two kinds of real estate are connected, both in construction and in use, and, taken together, answer the description in the sub-section "real property belonging to. . . any. . . incorporated company, and extending over more than one ward in any city," and what the section says is, that it may be assessed together in any one of such wards. That is what has been done here. It has been valued as a whole, that is, as if the company, being solvent, were conveying the whole to a creditor in payment of a just debt. In valuing the land of the company extending over several wards as a whole, the value of rails, poles, wires, etc., must be included as a part of the whole. But even if it becomes necessary to value a part of the company's real property separately, as in the case of that part which may be in a township outside of a city or town, where perhaps it has no land other than the rails, poles, wires, etc., on the public highways, the result must be the same. It must be the full value of these fixtures to the company, because they must be valued as an integral part of the whole. It plainly means that it is not to be valued without reference to the whole of which it is a part, but as an essential part of the whole—as something without which the whole would be incomplete. It is to be valued, in short, at what it is worth to the debtor, being solvent, as a part of the whole, so that being solvent, would be willing to let it go at that value in payment of a debt. Appeal dismissed with costs.

A CANADIAN ENTERPRISE IN BRAZIL.

A special meeting of the directors of the Sao Paulo Tramway, Light & Power Company, Limited, was held in Toronto on April 30th. This company is composed chiefly of Canadian capitalists, who have invested in an electric railway, light and power enterprise at Sao Paulo, Brazil. Mr. William MacKenzie is president and Mr. Frederic Nichols vice-president of the company.

At the meeting in question, it was decided to increase the capital stock of the company from six million to seven million dollars, this being necessary owing to the growth of business. The original capitalization contemplated the building of an electric railway in Sau Paulo, the development of water power at Parnahyba, the erection of power transmission line and the purchase of right of way. As the undertaking progressed the company further acquired by purchase the Sao Paulo Electric Light Company, the Viacoe Mule road, and the Santo Amaro Railway. It is now proposed to extend the company's electric railway line, increase the number of motor cars and the capacity of the lighting and power plant, provide additional transmission wires from Parnahyba to Sao Paulo, acd a second pipe line at the hydraulic plant. These extensions and improvements are estimated to cost about $750,000 and are expected to largely augment the present earning power of the company.

The electric railway commenced to be operated in May, 1900, the motive power being furnished from a temporary steam plant until the completion of the water power plant in September, 1901. For the fifteen months' operation with steam, the net profit was $139,823, but the next succeeding four months when operating by water power, showed a net profit of $151,333, making a total net profit up to the 31st December, 1901, of $291,156. Since that time the net earnings of the company have steadily increased. A dividend of 5 per cent. for the past year was declared.

MOONLIGHT SCHEDULE FOR JUNE.

Day of Month.	Light.		Extinguish.		No. of Hours
		H.M.		H.M.	H.M.
1....	P.M.	8.00	P.M.	3.30	7.30
2....	"	8.00	"	3.30	7.30
3....	"	8.00	"	3.30	7.30
4....	"	8.00	"	3.30	7.30
5....	"	8.00	"	3.30	7.30
6....	"	8.00	"	3.30	7.30
7....	"	8.00	"	3.30	7.30
8....	"	8.00	"	3.30	7.30
9....	"	8.00	"	3.30	7.30
10....	"	8.00	"	3.30	7.30
11....	"	10.00	"	3.30	5.30
12....	"	10.30	"	3.30	5.00
13....	"	11.00	"	3.30	4.30
14....	"	11.40	"	3.30	3.50
16....	"	0.10	"	3.30	3.20
17....	"	0.45	"	3.30	2.45
18....	"	1.20	"	3.30	2.10
19....	No Light.		No Light.		
20....	"		"		
21....	"		"		
22....	"		"		
23....	A.M.	8.10	A.M.	10.40	2.30
24....	"	8.10	"	11.10	3.00
25....	"	8.10	"	11.45	3.35
26....	"	8.10	"	0.15	4.05
27....	"	8.10	"	0.45	4.35
28....	"	8.10	"	1.30	5.10
29....	"	8.10	"	2.00	5.50
30....	"	8.10	"	2.30	6.20
			Total ..		137.40

QUESTIONS AND ANSWERS

If "W.B" will send his name and address, and explain fully the points on which he desires enlightenment, we shall endeavor to supply the information.

"Subscriber," Elmvale, Ont. : I am at present running a high speed Ideal engine (9 x 10), revolutions per minute, 350. Can I by putting in a counter shaft and reducing my speed to one half get the same power out of it? Explain fully.

ANS.—You will be able to get just the same power from your countershaft, no matter what the speed, except for the losses in it, or to put it another way, the horse power which will have to be developed by the engine to do a given amount of work will be greater, say by 10 per cent., if a countershaft is employed than if it is not used. We presume that you intend to keep the speed of the engine constant; its power will vary almost directly with its speed.

"Reader" : What would be a good dressing to put on a Manilla rope cable to help keep it from wearing? It has been in use now three years. We use it on an engine developing 150 h.p. It is 1¾ inches in diameter. How long do you think such a cable should last? There are four strands running off the drive wheel of the engine and one off the tightener, and five on the driven pulley on the line shaft. The distance between the line shaft and the engine shaft is about thirty feet. The tightener pulley, 3 feet in diameter, is one-third way between the two shafts, engine flywheels 10½ feet diameter, pulley on line shaft 4 feet.

ANS.—Dressings for Manilla power transmission ropes are composed principally of graphite and tallow, with a binder such as molasses. The exact ingredients and the proportions in which they are used are more or less trade secrets, all dealers in ropes for this purpose carry in stock dressing for their own particular brands. Your most advisable course is to buy from them and use according to their directions. It is difficult to estimate the life of a rope, from 3 or 5 to 8 or 10 years, depending very much on the load (strain or tension), velocity, care, etc.; under good average conditions you should get a life of seven or eight years. See answer to "Ned" in issue of December last.

"Student" : In answering my question No. 3, in the last number of the NEWS, you say : "The term true watts is sometimes used in alternating correct work, to distinguish that part of the current in a circuit which is in phase with the voltage from that part which is out of phase." I would ask, 1st, if the expression "in alternating correct work" as given by the types, was not intended by you to read "in alternating current work." 2nd, in measuring to get the voltage of the arc only, of an open arc direct current series lamp, has the term "true watts" any proper place or application in connection with the said measuring to get the voltage of the arc only, in the arc.

ANS.—1st. The reading given in our April issue, of "alternating correct work," was a typographical error, it should have read, as you say, "alternating current work." 2nd. In direct current work, except at the instant of closing or opening a circuit containing self induction, the current and voltage are always in phase with each other, and therefore there is no such a thing as apparent watts or true watts, or rather there is no such a thing as distinction between them, they are the same, and are called simply the watts of the circuit. It follows from this that the voltage at any instant, multiplied by the amperage at that instant, gives you the wattage of the circuit.

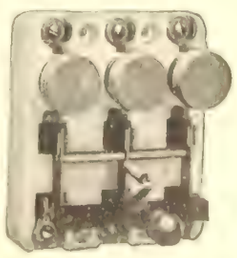
"Subscriber" desires to color some incandescent lamp globes, for decorative purposes, green, red and umber, by dipping into a solution that will leave them transparent and which when dry will not rub off.

ANS: The quickest method is to employ thin spirit lacquer, which may be made by dissolving aniline colors in alcohol, filtering the solutions and adding the same to a solution of gum sandarac in alcohol. For red, use eosine; for green, aniline green; for amber, a mixture of aniline yellow and Bismarck brown. Less than one ounce of these dyes will be required for coloring enough lacquer to dip twenty globes. For preparing sufficient lacquer for the three colors, powder one pound gum sandarac of the pale variety, place in a stoppered bottle with two quarts of 95 per cent. spirit, put in a warm place and shake occasionally, until the gum is dissolved; then add one-half pound clear Venice turpentine and filter. To hasten the solution, the bottle may be placed in a bath of warm water. Divide the resulting solution into three portions, and add to each the previously prepared alcoholic solutions of aniline colors, until the lacquer is of sufficient strength to suit your ideas, which you can readily test by dipping a piece of clear glass into the same. By following this plan you will obviate the use of an oven to dry your globes after dipping and obtain a more brilliant effect than by employing copal varnish.

NEW FORM OF SWITCH.



A very satisfactory form of fused switch has been put on the market by the Canadian General Electric Company, Limited, as shown in the accompanying cuts. It consists of a combination of the well-known punched clip spring switch with the Edison fuse plug. It is designed for 125 volt service, and its use makes the operation of replacing a fuse a safe and simple matter, which can be performed without tools. This feature, combined with the protection which the Edison plug insures, makes this form of switch applicable in many places where other forms of switches could not well be installed. The parts are mounted on a substantial porcelain base, and the device is made with double pole or triple pole single throw switches. The fuse plugs are furnished with any capacity up to and including 30 amperes.



TELEGRAPH and TELEPHONE

OPERATION OF TELEPHONE SYSTEMS.

In a paper read at the Interstate Telephone Convention, Chicago, April 10, 1902, Mr. H. S. Herr, referred as follows to the cost of operating telephone systems :

Very few who are engaged in the independent telephone business knew the expense of operating or the cost of maintenance, even approximately, when they entered into the business, much less did they consider that the expense increased, not only proportionately to the number of subscribers, but in an arithmetic progression. To explain : The expense of operating an exchange of 1,000 subscribers is much more than twice the expense connected with an exchange of 500. At first thought we naturally say that if you can give service to 500 subscribers at $1 per month, you can give service to 1,000 for less. Practice proves just the reverse. The reasons why are many, some of which may be plainly understood by the following :

When there are 500 subscribers connected with an exchange, each subscriber can call up 500 others, and by the time every subscriber calls up every other subscriber there are sent through the exchange 250,000 calls ; when there are 1,000 subscribers and every subscriber calls up every other subscriber once, there are not only twice as many calls sent through the exchange as there were when only the 500 were on the board, but four times as many, making 1,000,000 calls, which is the ratio in increase of the use of the telephone with the increase of subscribers. This requires four times as much labor to take care of 1000 subscribers as it does to take care of 500, and four times as much wear and tear on the apparatus, and much more central machinery or apparatus to do it with. The same is true on outside construction. Consider that the first 500 subscribers are within a radius of one mile from the exchange, with an average of one-half mile of pole lines, and in full metallic circuit, it means one-half mile of wire out and one-half mile in ; the second 500 come within a radius of two miles from the exchange, making an average distance of one and one-half miles for poles and wires, or three half miles out and three miles in, making the amount of construction to reach the outer 500 three times that of the first 500, and four times that required to serve the first 500 will be required to give service to 1,000.

I doubt whether this covers it all when we consider the amount of territory that must be covered by poles and wires as the circle increases. The territory to be covered within a radius of one mile is only a fraction less than four square miles. The territory covered in a radius of two miles is four times that, or sixteen square miles, requiring twelve square miles to be covered with poles and wires to serve the second 500, which, added to the cost of the first 500, would make four times as much pole cost to serve 1,000 subscribers as it requires to serve 500. To serve the out districts the wires can pass over the poles of the first districts, but the poles will have to be much larger and cost more. The amount of cross-arms and wires and insulators is the same as if all the wires were put on separate poles from the central office out.

SHORT-CIRCUITS.

The town council of Gravenhurst, Ont., are considering the installation of a municipal telephone system.

Tenders have just been invited for completing the installation of the telephone system at Gladstone and Plumas, Man.

The Edmonton District Telephone Company, of Edmonton, N. W. T., propose to extend their telephone line from Beaumont to Leduc.

Tenders are invited by the City o Ottawa, Ont., for installing a municipal telephone system, to be ready for operation April 3, 1903, and to be capable of serving 4,000 subscribers.

Mr. H. Locas, of Chenèville, Que., and others, are seeking incorporation as the Telephone Company of LaPetite Nation, to construct a telephone system in the county of Ottawa. The capital stock is $5,000.

The Luther Telephone Company has been organized, with a capital of $1,800, Dr. Campbell, of Grand Valley, Ont., is president of the company. The purpose is to build a telephone line connecting Grand Valley and adjacent villages.

The Canadian Press Association has passed a resolution expressing its approval of the action of the Dominion Government in granting financial assistance towards the establishment of the Marconi system of telegraphy between Great Britain and Canada.

The Parrsboro Shore Telephone Company is extending its operations. The new line from Parrsboro to River Hebert is in operation, and the extension to Amherst will shortly be completed. A telephone exchange is to be established at Parrsboro, which will start with about 50 subscribers. Mr. H. C. Jenks is in charge of construction work for the company. Mr. D. A. Huntley has been elected secretary as successor to Mr. Edward Gillespie.

There are in Canada, according to a statement made in the Dominion Parliament, 55 telephone companies, of which 44 are at present in operation, 25 in Quebec, seven in Ontario, six in Nova Scotia, five in New Brunswick, eight in British Columbia, two in the North-West Territories, and one in Prince Edward Island. The mileage of the Bell Telephone Company is 94,314. The total telephone mileage for the Dominion is 113,294.

Work is progressing rapidly on Marconi's wireless telegraphy station at Glace Bay, C. B. The land upon which the station is being built occupies ten acres. The power house and operating room are situated within a square formed by four towers, which towers are 210 feet apart. The power house is 55x51 feet and the operating room 70x51 feet, both about 20 feet high. The towers will be 210 feet high, tapering from 28 feet square at the base to 10 feet at top. They will be connected at points 70 feet apart by guys of steel wire cable. The force of these cables which is inward will be balanced by similar guys drawing the towers outward at the same point and fasted to anchors surrounding the base in the circle. The contractors for the work are Messrs. Rhodes, Curry & Company, of Amherst.

It has been decided to adopt electric power for the operation of the new C.P.R. shops in Montreal, for which plans are now being prepared. It is probable that the current will be obtained from one of the existing water power companies.

The town of Cornwall, Ont., recently invited tenders for electric lighting, two being received. The Stormont Electric Light & Power Company tendered as follows : Plan No. 1—75 or 80 arc lights, 2,000 c.p., 450 volts, for 5 years, 24½ cents per lamp per night or $89.43 per year ; for 10 years—23½ cents per light, or $85.77 per year ; plan No. 2—26 arc lights and 68 incandescent lights ; 5 years—Arc lights 25 cents per night, or $91.25 per year. Incandescent lights, 32 c. p., $23 per year ; 10 years—Arc lights, 24 cents per night, or $87.60 per year. Incandescent, $22 per year ; plan No. 3—123 incandescent lights, 32 c. p.—5 years, $23 per light ; 10 years, $22 per light. The second tender was from Mr. M. P. Davis and quoted prices for a ten-year contract only, as follows : For 80 arc lights, 30 cents per night, or $109.50 per year, total of $8,760.00 ; for 26 arc lights and 68 32 c. p. incandescent lights, arc lights $109.50 and incandescent lights $20.20 per year, a total of $4,532.00 per year ; for 123 32 c. p. incandescent lights, $29.50 per light, a total of $3,571.60 per year.

ENGINEERING and MECHANICS

THE USE OF STEAM.

In accordance with a resolution passed at the last annual convention of the Canadian Association of Stationary Engineers, the Educational Committee of the Executive are sending out to members a series of instruction papers. The first was on "The Generation of Steam," and the second on "The Use of Steam," the latter being given below:

Steam is a colourless, expansive, invisible fluid, and is produced by heating water or other liquids.

The subjects of steam and heat are therefore very closely connected. We cannot have steam without heat, neither can we have heat without motion, and this is one of its great factors of usefulness to mankind. Our steam engines then are in reality heat engines, and the steam is the medium by which the heat is carried from the coal to completed work at the engine cylinder. We say steam is an expansive fluid; and in this expansion is its great factor of usefulness to us. If we take water at 32 degrees F., and add 180 heat units to it, under our atmospheric pressure it boils, and its temperature is 212 degrees F. Up to this point we can measure the heat with a thermometer, this is called the sensible heat of steam. We also have what is called the Latent (or lost) heat of steam; this cannot be measured by the thermometer and comes about in the following manner:

If we take 1 lb. of water at 32 degrees F. and apply a fixed and known quantity of heat to it until it boils, we will assume that it takes 20 minutes, and we have supplied the water 180 heat units, which, added to the 32 contained in the water at the start makes 212 degrees F. or heat units, and is the sensible heat of steam at atmospheric pressure. Now let us continue the same quantity of heat per minute until all the water has evaporated into steam, we will find it has taken 5⅓ times as long or 107 minutes to do this work. Consequently we have used 5⅓ times 180 or 960 heat units, or to be exact it is 966 heat units. Now the temperature of the steam is the same as the water from which it was evaporated or 212 degrees F., and this 966 heat units is the Latent heat of steam at atmospheric pressure. All steam has a sensible heat corresponding with the temperature of the water it is evaporated from. If you boil water under a pressure of 5 atmospheres or 75 lbs. pressure, the sensible heat is 306 degrees F., the boiling point at that pressure, but the Latent heat has decreased by the same number of heat units that the boiling point increased, so the total is the same in all cases. In the first case we have 212°—32 + 966 or 1146, and in the second case, 306° —32 + 872 = the same, 1146 heat units.

In evaporating our 1 lb. of water under atmospheric pressure, the temperature remained at 212 degrees, but the volume was increased to 1644 times that of water in the second case; evaporating under 75 lbs. pressure the temperature also remained the same, 306 degrees F., but the volume is only 295 times that of the water it was evaporated from. This is one of the reasons it pays to run an automatic cut off engine.

The expansion of steam follows what is called Marriott's Law of expanding gases, which summed up means ½ the pressure doubles the volume. So if we let steam into an engine cylinder at 80 lbs. pressure, and cut it off at ¼ stroke, it is at 80 lbs. up to the point of cut off, at ½ stroke, because it has doubled its volume it is reduced to ½ pressure, or 40 lbs.; while at ¾ stroke the volume has trebled and the pressure has dropped to nearly 27 lbs., and this is why it is economical to run engines that use steam expansively. Steam at 27 lbs. pressure is very much cooler than steam at 80lbs., and this difference in its temperature has been converted into mechanical work by our steam (heat) engine.

Of the Latent heat that disappears in the formation of the steam we can recover a great part of it again when steam returns to water, that is, it gives up its Latent heat when condensed. That is one reason why steam is a good medium to heat our buildings, and also, a good reason why it requires so much cold water to condense the steam back to water quickly as in an engine condenser. Steam also has a very rapid movement. It will flow under a pressure of 1½ atmospheres into the air at a velocity of 67,500 feet per minute, and into a vacuum from a pressure of one atmosphere at the rate of 114,540 feet per minute, or 1,242 feet per second; this is why a steam pipe and the steam ports of a cylinder may have a very much smaller area than the piston itself, and the rate of flow of steam in pipes is how their sizes are determined. The whole science of the intelligent use of steam is to save, utilize, and direct its heat, the more of which we can capture and harness the more money we can save for our employers. The whole success in steam engineering is to stop heat wastes, and the man who can accomplish that the best, is the man with the big salary every time.

All engineers should carefully study the use of exhaust steam. Very nearly 9-10 of all the heat in the steam escapes into the atmosphere from an ordinary engine running non-condensing, and any of this heat that can be put to good use is clear gain. One of the first uses to put the steam to is the heating of feed water for the boiler; another is to heat water for any other purpose about the building or factory. Still another is to heat dry kilns of different kinds, and also the heating of the buildings. All of these things can be accomplished without adding more than 1 or 2 lbs. to the atmospheric pressure, against which all non-condensing engine pistons move. In the heating of feed water each 10 degrees F. added to it will save 1 per cent. of fuel —and if your feed water enters the boiler at say 40 degrees F., and you bring it up to 212 degrees F. by the use of exhaust steam, you have still left in the steam 966 — 212 = 754 heat units that may be used for other purposes. In heating your feed water from 40 to 212 degrees you have only condensed 2-11 of the steam used for that purpose. An economical 80 h. p. automatic cut-off engine using 30 lbs. steam per h. p. per hour, and discharging into the atmosphere at a back pressure of 1 lb. per square inch, will discharge heat enough to supply 9,000 square feet of radiating surface, or enough to heat a building containing 720,000 cubic feet of space.

What per cent. of fuel will you gain if you heat the feed water from 60 degrees to 210 degrees by the exhaust steam or other waste heat, the steam pressure being 60 lbs.?

By your steam tables you will find the sensible heat of steam at 60 lbs. pressure to be 30.7, and the latent heat will be 899, making the total heat units 307 + 899 = 1,206. The total heat supplied per lb. of steam is 1,206—60 = 1,146, but the feed water increases in temperature from 60 to 210, a gain in heat of 150 degrees. Therefore we have $\frac{150 \times 100}{1,146} = 13.86\%$

Rule.—Divide 100 times the difference between the final and the initial temperatures by the total heat units in the steam, minus the initial temperature of the feed water; or the formula will be thus:

$$100 \left\{ \frac{\text{Final temp. of feed—initial temp. of feed.}}{\text{Total heat units in steam—initial temp. feed water.}} \right.$$

Example—Initial temperature of feed water is 45 degrees, final temperature 210 degrees, steam pressure 100 lbs. gauge. Find the gain. Ans.—14.1%.

ENGINEERING NOTES.

About two hundred engineers have applied for examination this spring under the Steam Boilers' Inspection Act of British Columbia. Mr. John Peck, of New Westminster, is chief inspector for the province.

A bill was introduced in the British Columbia Legislature last month to amend the Steam Boilers' Inspection act, providing that an engineer with a certificate of service, series 2, given without examination, shall be qualified to take charge of the steam plant mentioned on the face of his certificate. After considerable discussion the amendment was passed.

The Montreal branch C.A.S.E. elected the following officers last month: President, M. R. Marchand; 1st vice-president, E. Valiquette; 2nd vice-president, F. H. Lavigne; recording-secretary, Alex. Belair; financial secretary, A. Leprohon; treasurer, E. Boyer; introductor, T. Leclair; door-keeper, O. Fontaine; trustees, Achille Leprohon, E. Brisebois, R. Drouin; executive board, R. Drouin, R. Marchand, J. Hartenstein; promoter of education, E. Valiquette.

CLARKSON SCHOOL OF TECHNOLOGY.

Mr. William S. Aldrich, director of the Clarkson School of Technology, Potsdam, N.Y., has sent us a list of subjects for graduating theses for June, 1902. The subjects serve to indicate the character of the work carried on in this institution. They are as follows: "Development of the Water Power of High Falls on Deer River"; "A Study of the Possibilities of the Development of Water Power on the Indian River"; "A Design for a Power Plant on the Indian River"; "Investigation of the Properties of Liquid Condensers"; "Influence of Chemical Composition on the Electric Conductivity of Wrought Iron and Soft Steels"; "Performance of a Motor Generator Set vs. a Rotary Converter of the same capacity"; "The Design, Construction and Performance of an Experimental Polyphase Transmission Line"; "An Experimental Study of a Single-phase Induction Motor"; "Installation of, and Experiments on, a 15 H. P. Otto Gas Engine"; "Experiments on the Flow of Steam through Rectangular Orifices"; "Design of a Compound Marine Engine."

SUCCESSFUL McGILL STUDENTS.

The following students were successful in the course of electrical engineering at the spring examinations of McGill University, Montreal: Frederick S. McCloskey, Boiestown, N. B.; George H. Cole, Ottawa, Ont.; George K. McDougall, Montreal, Que.; John H. Cardew, Young's Point, South Beach, Ont.; Louis H. Narcotte, Westmunt, Que.; John A. Wenger, Ayton, Ont.; Myles H. Roffeym, Braintreem, Essex, England; Cecil G. Devlin, Mohawk, Ont.; Moses A. Fullington, Newport, Vt.; Oswald A. Mundy, Hamilton, Ont.; Ernest A. Piche, Montreal, Que.

TRADE NOTES.

Babcock & Wilcox, Limited, Montreal, have removed their offices to the New York Life Building.

The Robb Engineering Company, Amherst, N. S., are supplying two boilers for heating and power purposes to be installed in the new Strathcona apartment building in Winnipeg.

We have received an attractive catalogoue of small motors for sale by the Canadian General Electric Company, who report an increasing demand not only for motors for use with direct current, but also for small motors for alternating current circuits.

The Pittsburg Transformer Company, of Pittsburg, Pa., devote that energy and capital exclusively to the manufacture of transformers. This company was organized in 1897 and has been compelled to frequently enlarge their plant. Their transformers were awarded a bronze medal at the Paris Exposition of 1900.

The Pittsburg Transformer Company, of Pittsburg, Pa., is shipping its specialties to Kopmann & Co., of Amsterdam, Holland, through its managers for foreign sales, the Goudey-McLean Company, of 88 Maiden Lane, New York City. The Pittsburg concern has opened a New York office under the management of A. H. Mustard, formerly of the Wagner Electric Manufacturing Company. The new office is located in the Beard Building, 120 Liberty Street.

The Packard Electric Company, of St. Catharines, Ont., have secured the exclusive Canadian manufacturing and selling agencies for the Hylo turn-down lamp. This lamp has two filaments, one being of the usual size, giving 16 or 18 candle power, the other being exceedingly small and giving only a one-candle power light. The slightest turn of the lamp will extinguish the large filament and light the small one. By this means a saving is effected of five-sixths of the current ordinarily consumed. The two filaments of the Hylo lamp have a combined life of 4,000 hours, 1,000 for the big filament and 3,000 for the "Baby" filament, giving to the Hylo a life claimed to be three times that of an ordinary 16 candle power lamp.

The bill of the Ontario Power Company, which proposes to transmit power from Niagara Falls to Toronto, was defeated in the Private Bill Committee of the Dominion Parliament last month.

The tender of the Canadian Heine Safety Boiler Company, of Toronto, has been accepted for furnishing three boilers for the Toronto waterworks. The price is $11,231. There were two other tenderers. The old boilers have been sold for $270.

SPARKS.

Mr. W. K. Vanderbilt, jr., is said to have made a remarkable performance with a motor car, covering the distance from Monte Carlo to Paris, 644 miles, in 17 hours.

Mr. C. H. Mitchell, C. E., of Niagara Falls, Ont., is superintending the construction of the new power house for the Niagara, St. Catharines & Toronto Railway Company at Merritton.

Messrs. E. J. Philip, G. W. Grant, T. H. Hamilton, and T. D. Lovering have been incorporated as the Dominion Motor & Machine Company of Toronto, with capital of $40, 000. to manufacture automobiles, gasoline engines, etc.

Mr. Norman Smith, E. E., has presented to the council of Toronto Junction, Ont., a report on electric lighting. It was divided into three parts. Report No. 1 suggested that the town discard the present dynamo and lamps and purchase new ones, at a cost of $6,166. The second report suggested that the present boiler, dynamo and series lamps be discarded, and that there be installed a new boiler, an alternating current generator, and 35 new arc lamps, at a cost of $7,495. With this plant there would be an additional cost of $2,000 for transformers and meters. Report No. 3 suggested that in addition to the apparatus recommended in No. 2, there be installed a new engine at cost of $2,300, a boiler at cost of $1,425, generator and switchboard at cost of $2,700, and other necessaries at cost of $820. The report is under consideration by the council.

The Lachine Rapids Hydraulic & Land Company, of Montreal, have been awarded the contract for street lighting by the municipality of St. Cunegonde, Que., the price being $90 per lamp per year. Since 1892 the Royal Electric Company has been lighting the streets at $100 per lamp per year, and the company offered to renew its contract, which expires May 1st, at $88.40 per light, but the council decided that a fifty year franchise, which was granted to Mr. Robert Bickerdike in 1892, and subsequently transferred to the Lachine Company, to begin this year, was to be observed, hence the award. This means that the Lachine Company has a fifty-year contract, but there is a clause that the rates for street lighting shall be determined by arbitration every ten years, and that private consumers shall be provided with power and light at the rates current in the city of Montreal.

Mr. A. L. Boucher, electrician, employed by O'Reilly & Murphy, Ottawa, states that he will shortly place before the public a new heating device which for intensity of heat and melting power will show some startling developments. He claims that the hardest substances, such as cast steel, etc., will readily melt and flow even when placed at a distance of 9 inches from the machine. During the first experiments he contends that an ordinary Fahrenheit thermometer of 212 degrees was used to register the amount of heat obtained from the machine, but with current applied the result was that the glass part was instantly reduced to liquid form. During the next experiment a centigrade thermometer of 512 degrees replaced the Fahrenheit, but fared the same and quickly melted before the intense heat. Next a bar of cast steel was employed, but even this, hard as it is, was not proof against the remarkable qualities of the new discovery, but melted like wax before a flame. This would go to show that to accomplish this result a temperature of 2,520 degrees was required, being the fushion of steel, or heat at which this metal will melt.

PUBLICATIONS.

A second edition of a popular exposition of wireless telegraphy by C. W. de Tunzelmann, B.Sc., etc., has recently been issued by the publishers of "Knowledge", 326 High Halborn, London; price 1s 6d. The book, which comprises 100 cloth bound pages, records the historical development of wireless telegraphy and describes the means by which some knowledge may be obtained about the physical facts upon which the practice of etheric telegraphy is based.

We have received a copy of the first issue of the American Electric and Automobile Patents Monthly, published by the American Patents Publishing Company, of Washington, D. C. The purpose of this journal is to publish full drawings and descriptions of all patents relating to the electric and automobile industry, as well as air and gas engines. The services of Mr. James T. Allen, of the United States Patent Office, have been secured as compiler of the magazine. The subscription price is $5 per annum.

TECHNICAL SCHOOL EXAMINATIONS.

The following students of the Toronto Technical School were successful in the courses named at the spring examinations last month :

Steam Engine.—Class 1—E. S. Baker. Class 2—H. Satchell, E. Clendenning, S. Waddel and C. J. Parker, equal ; J. Mar in and C. W. Rabey, equal. Pass—G. Chrysler, A. Stretton.

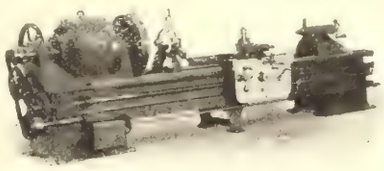
Electricity.—Second year, Class 1—E. B. Ratcliffe, C. Radford, M. Adams, C. Hand, W. Cole, W. R. Maxwell, R. Blacklock, F. Dehlinger, E. E. Smalley, W. Young. Class 2—T. Williams, M. Campbell, J. Gardner, J. Burns, W. J. Leggott, G. J. Beattie. Pass—W. T. Coats, R. Thomson, J. Hocking, J. Albright, W. S. Bayley, F. Brown, J. Williamson. First year, Class 1—E. B. Ratcliffe, W. R. Maxwell, M. Adams, C. Hand, T. Williams, S. Waddell, W. H. Beales. Class 2—H. Satchwill, C. Radford. Pass—J Albright, E. E. Smalley.

The Charlottetown Electric Light & Heat Company, Charlottetown, P. E. I., is installing a 350 h. p. Peerless engine.

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3 10-light Shellenberger Watt Meters.
2 20-light Duncan Watt Meters.
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Proposals are invited by the Corporation of the City of Ottawa as follows :

1st.—For installing a Telephone System, equal at least to the Bell Telephone Company, ready for operation April, 1903, and capable of serving 4,000 subscribers. The proposals to state whether the system will be overhead wires or underground.

2nd—What amount of money an individual or company will pay the City of Ottawa annually for the privilege of operating a telephone system for a period of ten years from April, 1903, equal to the Bell Telephone Company's, the rate to subscribers not to exceed $20 per annum.

Proposals marked "Tender" on envelope addressed to Alderman Ellis, Chairman of Finance Committee, will be received up to 4 o'clock of THURSDAY THE 29TH DAY OF MAY, 1902.

JOHN HENDERSON,
City Clerk.

Ottawa, 30th April, 1902.

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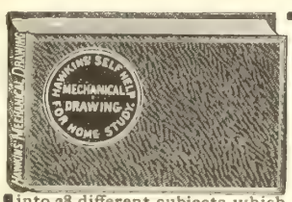
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SPARKS.

The car barns of the Niagara Falls Park and River Railway at Chippewa, Ont., were destroyed by fire on April 30th.

The city council of Nelson, B.C., have asked the Provincial Government to provide a site for a municipal electric light plant at Bonnington Falls.

The North Sydney Electric Light Company are considering a proposition made by the Cape Breton Electric Light Company for the purchase of their plant

The Sherbrooke Gas & Water Company, of Sherbrooke, Que., are about to commence the construction of a new dam in connection with their power plant.

Engineers are surveying the proposed route of the tramway to be built by the Cape Breton Electric Company between North Sydney and Sydney Mines, N. S.

The Niagara, St. Catharines & Toronto Railway Company propose to let the contract immediately for the extension of their road to Hamilton, a distance of 33 miles.

The town of Berlin, Ont., has passed a by-law giving a franchise to the Berlin & Bridgeport Electric Street Railway Company, and it is said that the work of construction will be proceeded with at once.

An arrangement was concluded recently by which the Island Pond Electric Light & Power Company, of Island Pond, Que., will furnish the Stanstead Electric Company with power to operate their electric plant during the next twelve years.

The Western Electric Company have opened business at 195 Portage avenue east, Winnipeg, the members being Messrs. W. S. King and D. H. Fleming. They have secured the agency for the Galvanic Battery Works, of Toronto, and other concerns.

The recently installed electric light plant in the town of Glace Bay, N. S., is proving a success in every way. It is proposed by C. M. Odell, C. E., who is preparing the plans and specifications for a complete system of waterworks, to use the same plant for furnishing power to operate electric pumps in connection therewitn,

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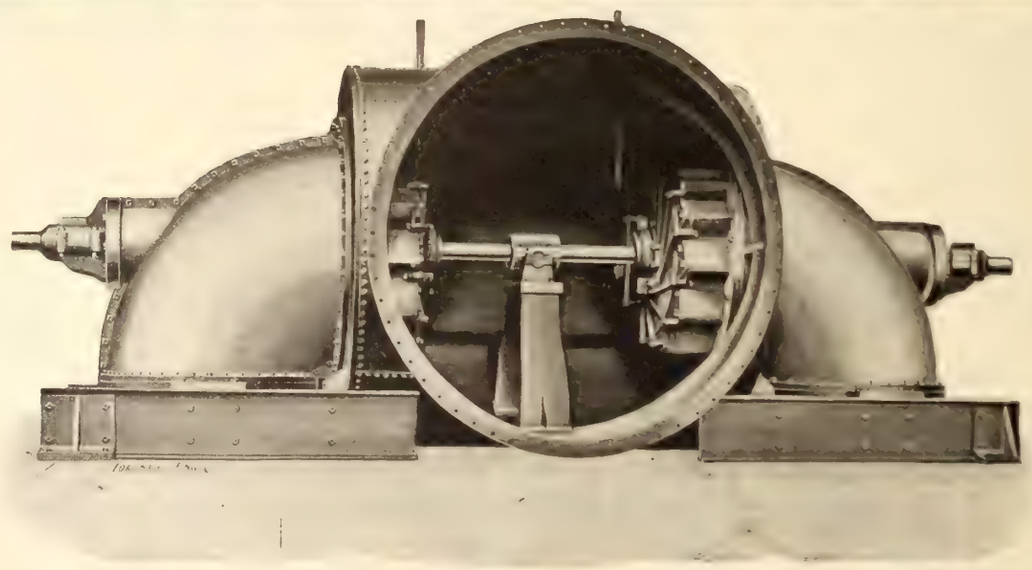
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SHERBROOKE, QUE.
CANADA.

SPARKS.

The Levis Electric Railway Company are building a large car shed.

The town clerk of Goderich, Ont., has been instructed to secure prices on transformers for the electric lighting plant.

The Montreal Light, Heat and Power Company propose to double the capacity of the Chambly power house by the addition of four more generators.

A printing plant is being installed in the School of Practical Science, Toronto, where all the University printing will in future be done. The presses are operated by motors direct-connected, and their operation is almost noiseless.

The Montreal Southern Counties Electric Railway Company have asked the Legislature for permission to use steam power and to connect with all steam and electric railways where their lines touch.

Mr. Andrew Bell, C. E., of Almonte, Ont., has made a survey of Mr. H. F. Cloran's property at Evandale with a view to developing electric power. Mr. Bell reports that by cutting a canal through the island considerable power could be developed.

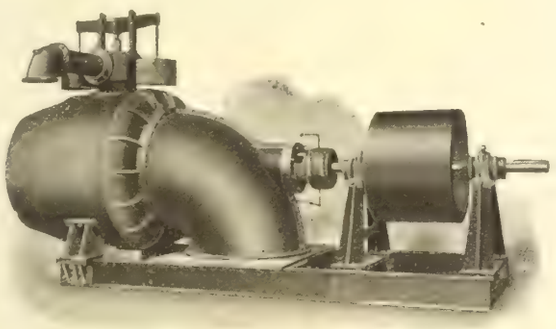
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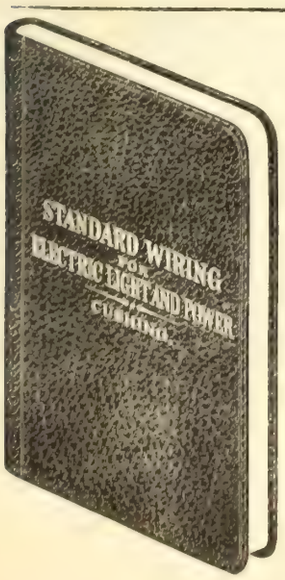
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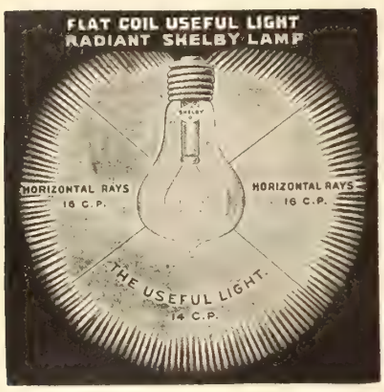
The Winnipeg Street Rai way Company has just completed a new car barn, 134x290 feet. It is constructed of brick and structural iron, and with the plant cost $50,000. It is divided into four sections, one being the car barn proper and the other the car shops. The capacity is 72 cars.

Bernier & West, of Montreal, brought action against the Lachine Rapids Hydraulic & Land Company to recover damages for loss by fire in their business premises. They alleged that the fire was caused by defective wiring, due to the negligence of the Lachine company. Much evidence was taken, including electrical experiments by Mr. F. Thompson to explain certain phenomena which had been seen during the fire. The jury after brief deliberation returned a verdict for the defendants with costs, contending that there had been no negligence on the part of the company.

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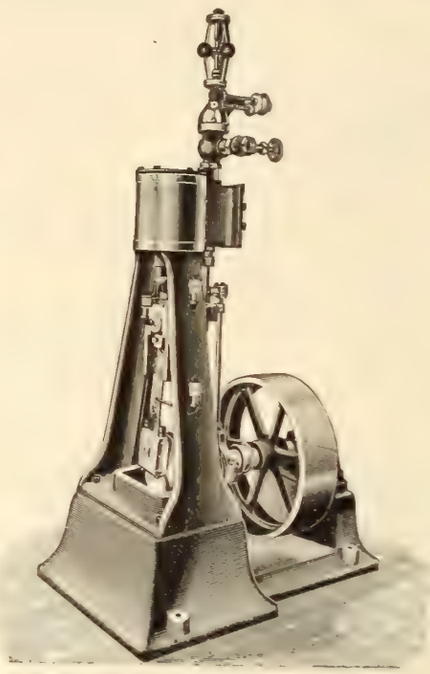


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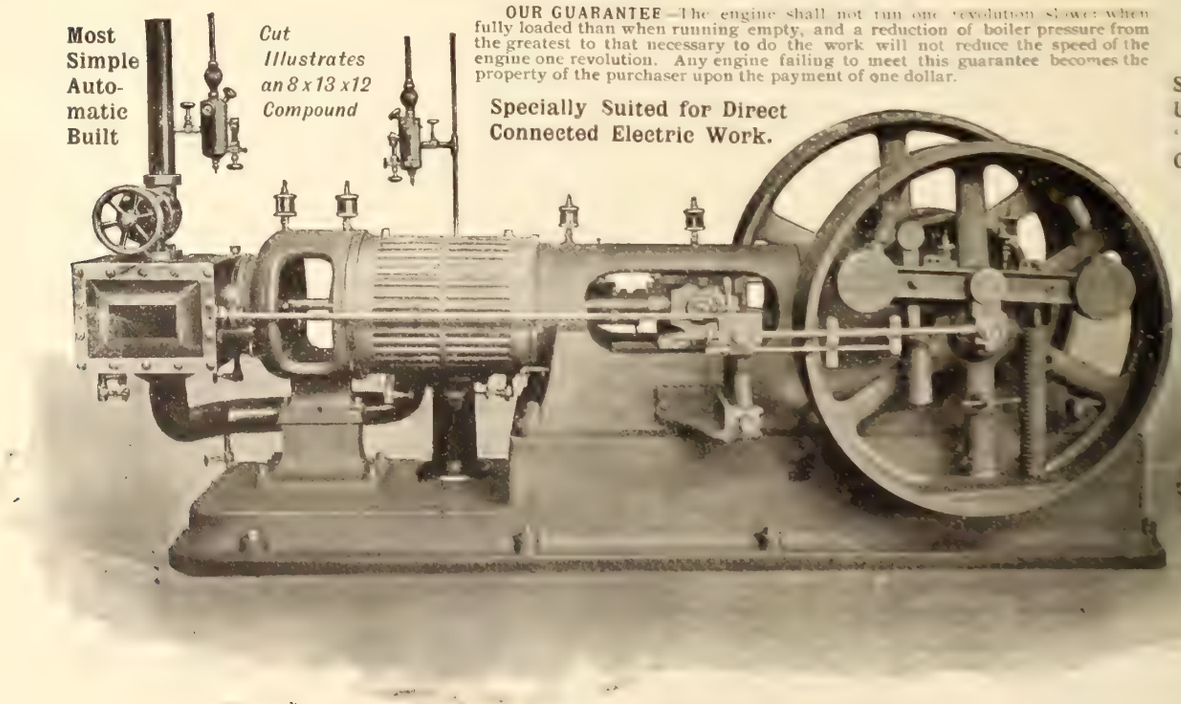
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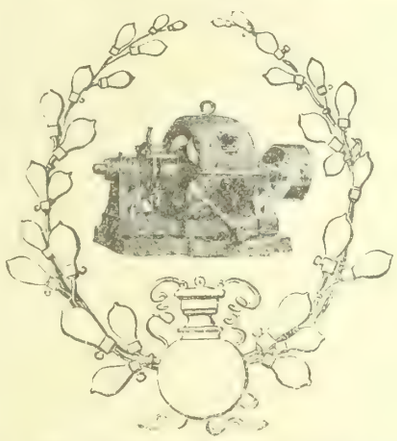
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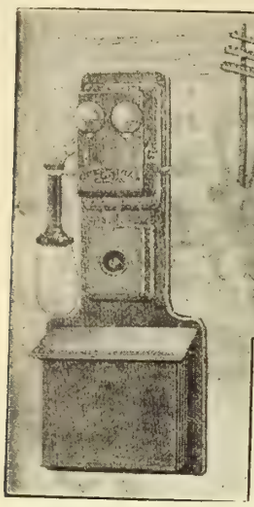
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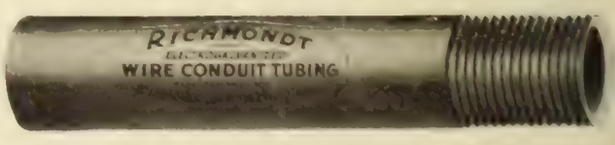
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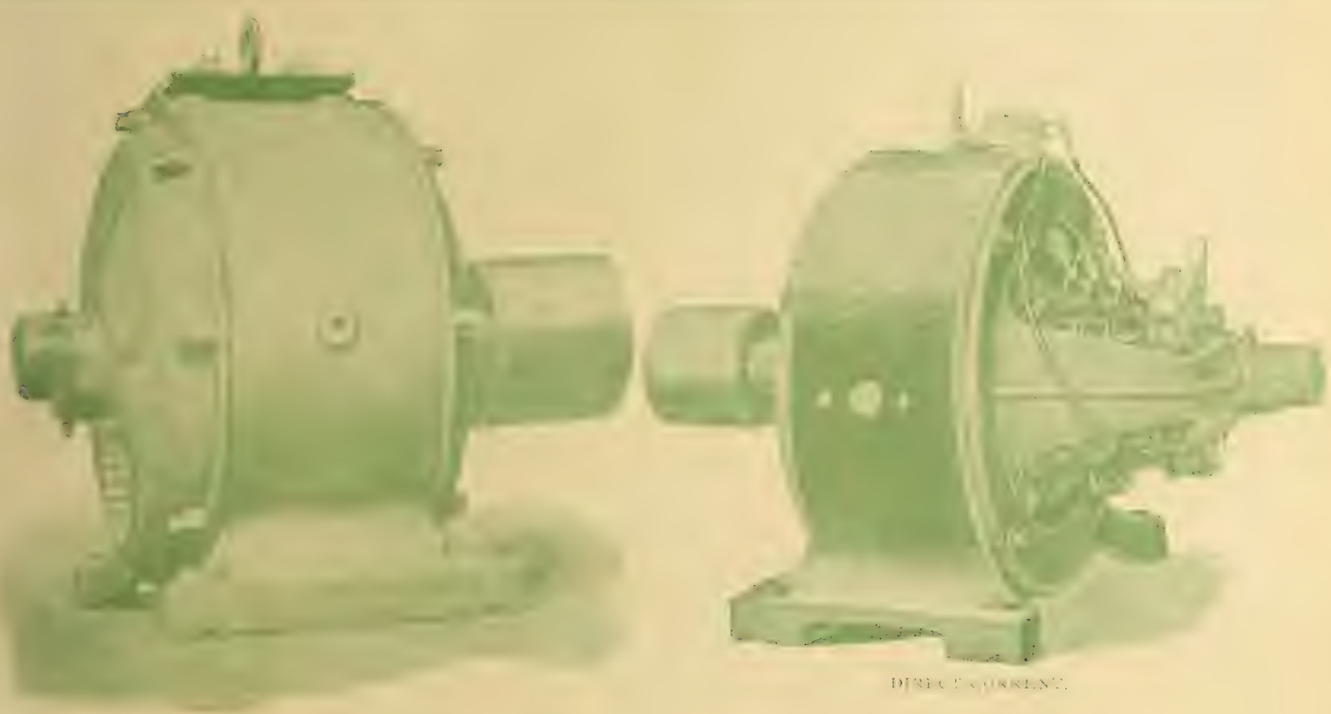
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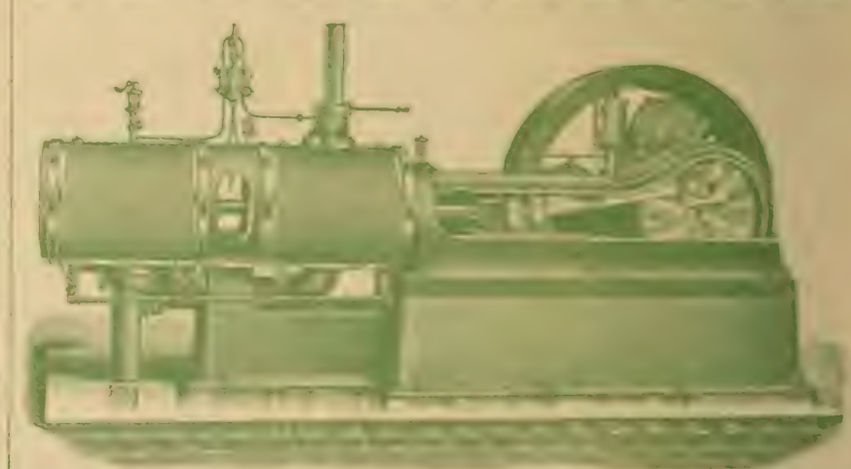
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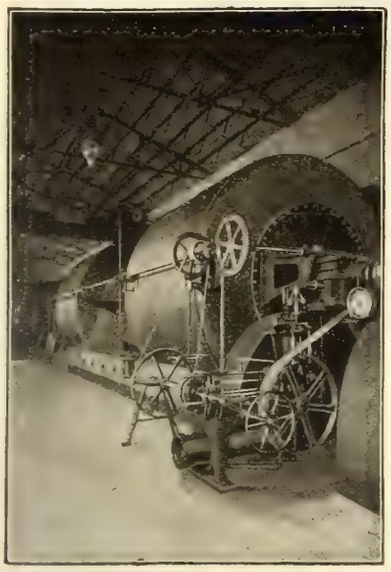
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WRITE FOR CATALOG. DEPARTMENT E.

SPARKS.

The electric light plant at Cannington, Ont., owned by Mr. Dobson, was destroyed by fire on May 21st.

The W. C. Wilson Company, Limited, Toronto, dealers in engineers' supplies, recently made an assignment.

The Bell Telephone Company are establishing an exchange at Sudbury, Ont., with a long distance connection.

Messrs. G. R. Ashwell & Sons, general merchants, Chilliwack, B.C., are building a telephone line to their branch store in Sadis.

The Dominion Government is asking for tenders for installing an electric light plant at the quarantine station, Williams Head, B.C.

The tender of John McDougall & Company, for a new electric pump for the Montreal waterworks, has been recommended for acceptance. The price is $40,025.

The Nesbitt Electrical Company has started in business at 33 Fort street, Victoria, B.C., and will carry a large stock of electrical supplies. Mr. J. S. Nesbitt is manager.

The city council of Winnipeg, Man., have accepted the tender of the Western Electric Company, of Chicago, for the supply of switch-board, registers and batteries for the electric light plant.

The ratepayers of Fort William and Port Arthur, Ont., have decided by vote in favor of municipal ownership of the telephone system. The proposed charge is $24 for business telephones and $12 for house connections.

Messrs. Carse & Dayly, electrical engineers, Victoria, B. C., have secured the contract for wiring the new Hudson's Bay steamer and for wiring and placing of bells in the new Pacific cable station to be constructed at Bamfield Creek.

At the annual meeting of the St. Martins Telephone Company, St. Martins, N. B., the following officers were elected : Walter Allan, president ; C. D. Trueman, vice-president ; A. W. Mac-mackin, secretary - treasurer ; Walter Allan, C. M. Bostwick, W. E. Skillens, C. D. Trueman and Robert McLeod, directors.

A meeting of the provisional directors of the Toronto & Niagara Power Company was held in Toronto recently, when Lieut.Col. Pellatt was elected president, Mr. Frederic Nichols vice-president, Mr. William McKenzie second vice-president, and Mr. R. G. Nicholls secretary-treasurer.

The Peterborough Hydraulic Power Company have just taken tenders on the construction of concrete dam, power house, tail race and railway bridge. The power house will be 108x80 feet, of brick, on concrete foundation. Mr. Charles H. Keefer, of Ottawa, is consulting engineer for the company.

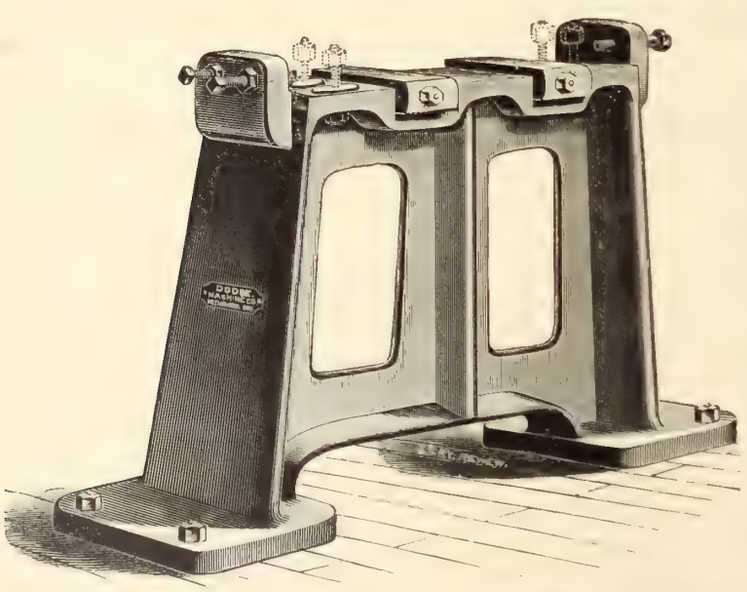
The C.P.R. Telegraph Company has given a contract for 200 tons of No. 9 copper wire. This will string about 2000 miles of line and will be used towards increasing the existing facilities of the company. New lines are to be strung from Sydney to Halifax, from Montreal to St. John, N. B., and from Montreal to Sault Ste. Marie. In addition about 130 miles of iron wire will be strung between St. Thomas and Walkerville, Ont.

It is reported that the amalgamation is about to take place of the Montreal Street Railway Company and the Montreal Light, Heat & Power Company. Several appointments pointing in this direction have recently been made. Mr. A. G. Ross, secretary-treasurer of the Street Railway Company, has been appointed comptroller of the Light, Heat & Power Company, while Mr. F. S. Pearson has been appointed to the position of constructing engineer for the two companies. Mr. Mershon, also of New York, has been made chief engineer of construction work for both companies.

The paper on "Static Strains in High Tension Circuits and the Protection of Apparatus," recently read by Mr. Percy H. Thomas before the American Institute of Electrical Engineers, has been reprinted in full. The author treats the subject in a comprehensive manner and, because of the non-mathematical character of the work, it will doubtless prove of interest to superintendents and station managers, as well as electrical engineers. The reprint is copiously illustrated with diagrams and with views of the Westinghouse static interruptor. A copy can be obtained by writing to the nearest district office of the Westinghouse Electric & Manufacturing Company.

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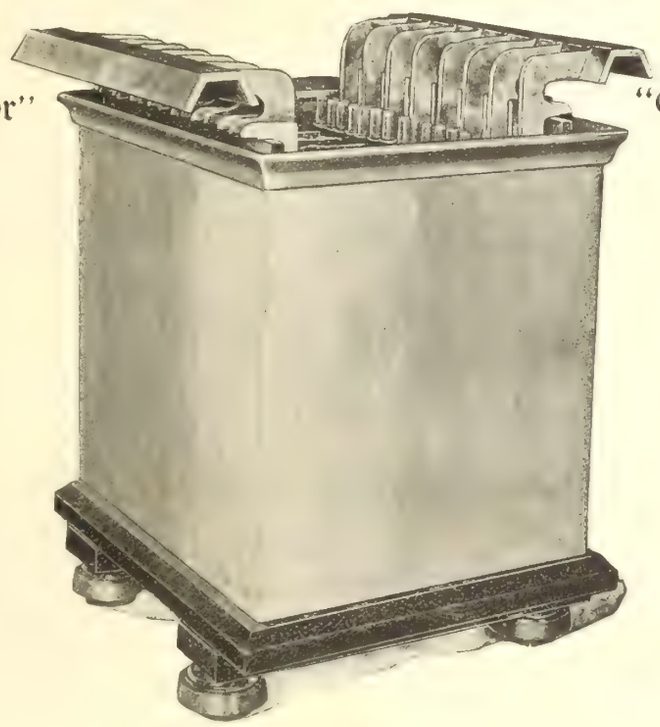
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TESTING ELECTRICAL ACCESSORIES.

The suggestion made by Mr. Wordingham to the Institute of Electrical Engineers, that it should undertake the work of testing electrical accessories and fittings, seems to us to be an excellent one, says the London Builder. The increased pressure of supply now in general use makes it imperative, both in the interests of consumers and manufacturers, that only certified articles should be used in electric circuits. We had occasion recently to test a small switch which controlled five 16 c.p. lamps on a 240 volt circuit. When it was pushed smartly down it broke the circuit satisfactorily, but on breaking the circuit slowly the arc set up destroyed the switch. In our opinion this switch, which is of a fairly common type, ought never to have been put in the circuit. With 240 volts the fittings need to be of very much better material and much more carefully designed than when 100 or even 200 volts is the pressure employed. An ordinary 100-volt 5-ampere switch only breaks a 240-volt circuit when the arc set up has melted most of the metal inside the switch. Another point that has now to be considered in connection with switches is the insulation resistance of the base of the switch. There may be nothing to choose apparently between two switches, and yet the insulation resistance of one may be so low that, if it is fixed in a cellar, for example, it will lower the resistance of the whole wiring so much that the supply company will refuse to connect the installation to its mains. The other switch may have an insulation resistance so high that it is practically impossible to measure it. If the Institution started a testing laboratory for electrical accessories, something similar, for example, to the meter-testing laboratory of the Board of Trade, then we are sure manufacturers would gladly avail themselves of the opportunity of enhancing the value of their wares by getting them officially approved. Architects would have more confidence in specifying electrical fittings for their clients if they knew that these fittings had been certified as suitable by an independent authority.

MOONLIGHT SCHEDULE FOR JULY.

Day of Month.	Light.		Extinguish.		No. of Hours
		H.M.		H.M.	H.M.
1....	P.M.	8.10	P.M.	3.30	7.20
2....	"	8.10	"	3.30	7.20
3....	"	8.10	"	3.30	7.20
4....	"	8.10	"	3.30	7.20
5....	"	8.10	"	3.40	7.30
6....	"	8.10	"	3.40	7.30
7....	"	8.10	"	3.40	7.30
8....	"	8.10	"	3.40	7.30
9....	"	8.10	"	3.40	7.30
10....	"	8.10	"	3.40	7.30
11....	"	9.40	"	3.40	6.00
12....	"	10.15	"	3.50	5.35
13....	"	10.45	"	3.50	5.05
14....	"	11.30	"	3.50	4.20
16....	"	0.00	"	3.50	3.50
17....	"	0.45	"	3.50	3.05
18....	"	1.30	"	3.50	2.20
19....	No Light.		No Light.		....
20....	"		"		....
21....	"		"		....
22....	"		"		....
23....	A.M.	8.00	A.M.	10.20	2.20
24....	"	8.00	"	10.50	2.50
25....	"	8.00	"	11.20	3.20
26....	"	8.00	"	0.00	4.00
27....	"	7.50	"	0.30	4.40
28....	"	7.50	"	1.15	5.25
29....	"	7.50	"	2.00	6.10
30....	"	7.50	"	3.00	7.10
31....	"	7.50	"	4.00	8.10
				Total	148.40



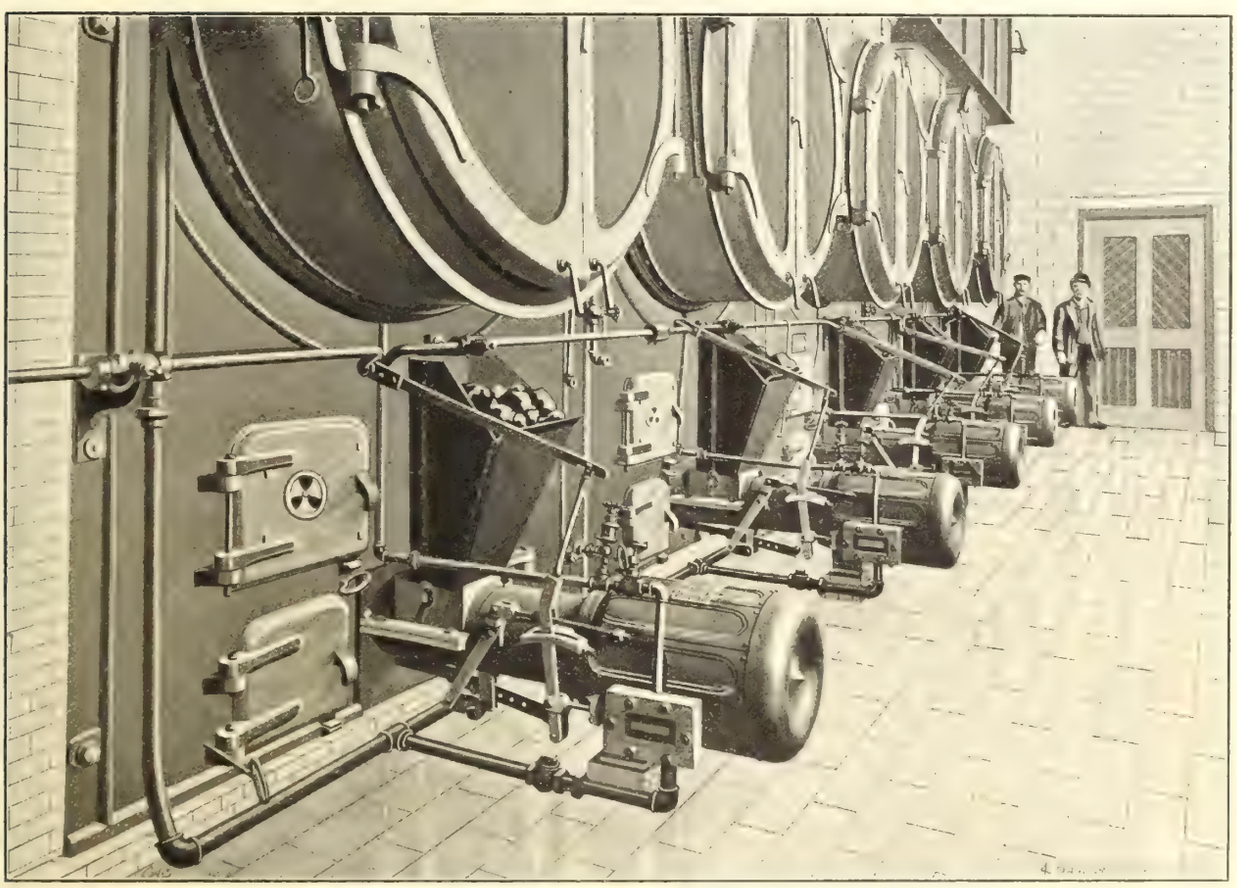
THE JONES UNDERFEED STOKER

Efficiency — The nearest approach to the theoretical in actual practice.

Durability — No working parts in proximity to the heat. Repairs less than on ordinary grate bars.

Simplicity — Can be mastered in a day.

Capacity — The "JONES" will do from 25 to 50 per cent. more work than can be done in ordinary working condition hand firing, with from 15 to 35 per cent. increase in economy, as shown by 500 tests on boilers operating under all conditions.



The Boiler Room of the Dominion Bridge Works, Lachine, Que.,
Showing an ideal system where the intensity of the draft and the amount of coal fed into the furnaces are automatically controlled by the steam pressure.

Guarantees

- Not less than 10 per cent. saving in fuel bills.
- Boilers can be run from 33⅓ to 75 per cent. above builders' rating.
- Practically smokeless stack.

See results of test on page 91 this issue made at T. Eaton Company's plant.

Actual Saving 19.7 per cent.

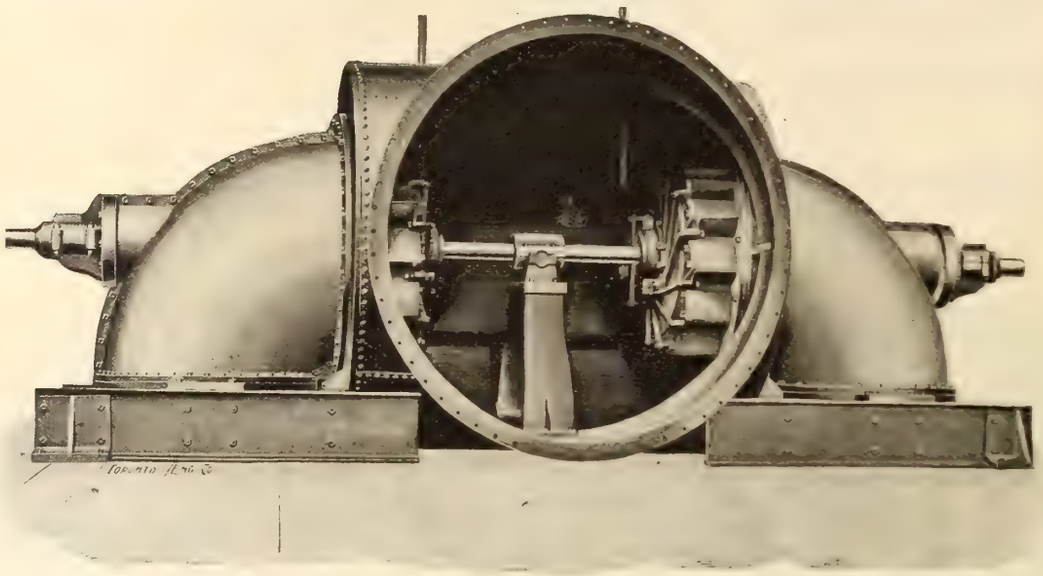
THE JONES STOKER — TESTIMONY OF PROFESSOR — LATE PROFESSOR OF ENGINEERING McGILL UNIVERSITY MONTREAL — JOHN. T. NICOLSON. — HAS REVOLUTIONIZED THE ART.

The Underfeed Stoker Co.
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CHICAGO, Marquette Bldg. NEW YORK, 149 Broadway. BOSTON, 721 Exchange Bldg.
PITTSBURG CLEVELAND

WATER POWER PLANTS



THE above plate represents one of many styles of settings which may be adopted in connection with Electric Lighting or Electric Power Plants. The wheels being arranged in pairs, end thrust is neutralized, and superior results are also obtained as regards steadiness under variations of load and ease of operation and maintenance.

In some instances the same general arrangement is followed, but the turbines are mounted on separate shafts with an additional bearing and stand inside the case, so that the wheels may be run independently.

The Crocker Patent Turbine

This type of Water Wheel has won the approval of experienced users of turbines, and those who have expressed their views in its favor have not been slow in advancing what, after all, are the best proofs of merit, viz., repeat orders.

The following extract from a letter received is a fair example of the views of those who have given our turbine long and ample trial in daily work :

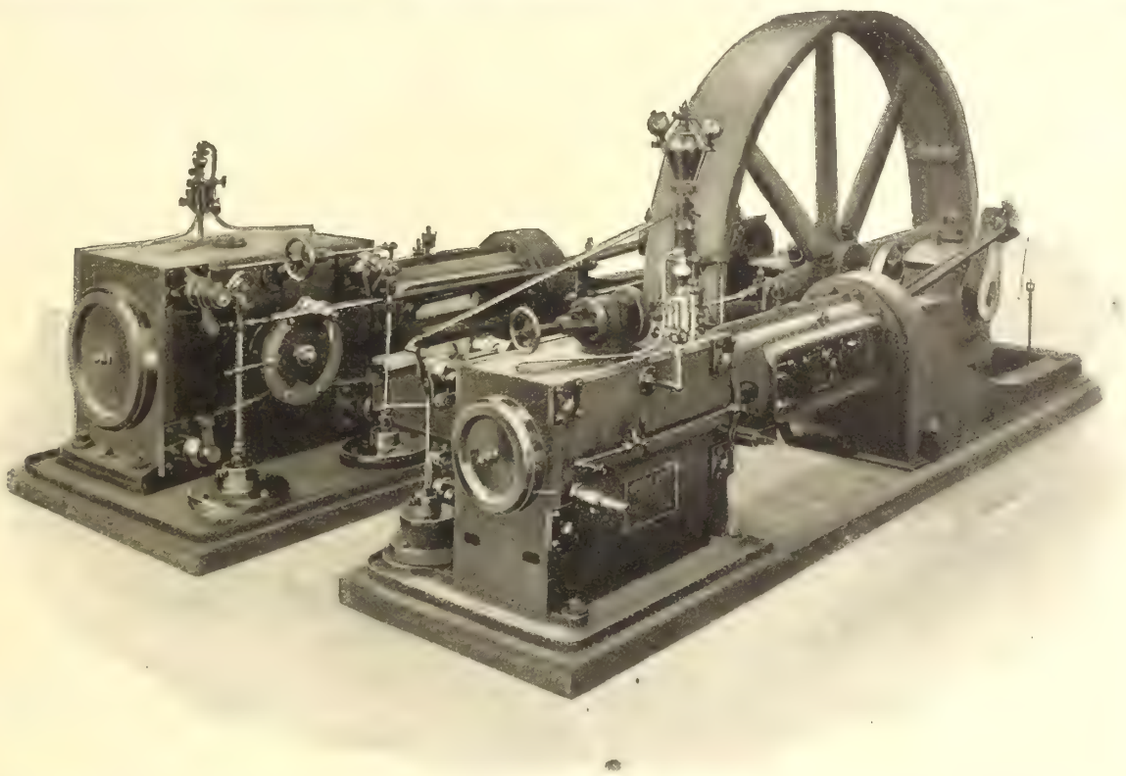
> "We have been using three pairs of these wheels for the past eight years. Two years ago we had occasion to install another pair, and did not hesitate to put in the same kind. At the same time we were in a position to know actual results from other makes of wheels, and to-day if we were going to put in more wheels, we should take Jenckes-Crocker wheels."

We prefer to contract for complete plants, designed to meet the local conditions, and fully equipped with all that may be required in the form of Steel Plate Work, Tubing, Penstocks and Cases, Gate and Head Rack Work, Shafting, Friction Clutches, Rope and Belt Drives, Governors, etc., modern in design and all details perfectly adapted to each other.

Inquiries invited from users and owners of water power, and all interested in water power development for any purpose.

The JENCKES MACHINE COMPANY
32 Lansdowne Street
Sherbrooke, Quebec, Canada

STEAM POWER PLANTS



The Jenckes Corliss Steam Engine

CROSS COMPOUND TYPE

TYPES:

- Simple
- Compound
- Tandem
- Cross
- Condensing
- Duplex
- Hoisting
- Special

These engines are built from new patterns, and we aim to have them embody all that is desirable in recent modern practice.

Girder frames are only used with 10″ and 12″ cylinders, all sizes above 12″ having Tangye beds, and for exceptionally heavy duty the slide barrel has a base resting on the foundation the full length of slides.

Governors are fitted with ball bearings and improved safety stop, and the valve gear is of our own special design, arranged with a view to securing sensitiveness, quick action and quiet operation.

Inquiries are solicited from firms and corporations contemplating alterations or extensions of their steam plants or in the market for new equipment. Opportunities afforded us of submitting tenders will receive careful attention and be much appreciated.

Estimates submitted and designs prepared for complete Steam Power Plants, including Steel Boilers for ordinary or high pressures; Pumps, steam or power driven; Heaters, Condensers, Reheaters, High Grade Corliss Engines and all accessories.

Self-supporting Steel Stacks, with Breeching, etc.; Induced Draft Plants a specialty, complete with Engine, Fan, Steel Plate Work and Girders, etc., as required.

Contracts undertaken for construction, delivery and erection of Steam Power Equipment in any part of the Dominion. Competent engineers sent to any point, and examinations and reports made on existing or contemplated installations.

POINTS:

- Efficiency
- Economy
- Durability
- Closeness of Regulation
- Noiselessness in Operation
- Reliability

Sales Offices:

81 York Street, TORONTO, ONT.

18 Victoria Square, MONTREAL, QUE. 194½ Hollis Street, HALIFAX, N. S.
ROSSLAND AND GREENWOOD, B. C.
Winnipeg Machinery & Supply Co., WINNIPEG, MANITOBA.

SPARKS.

The electric light plant at Farnham, Que., was recently sold to L. P. Morin, of St. Hyacinthe, for $6,000.

The Pembroke Electric Light Company, of Pembroke, Ont., are building an addition to their boiler house, in which they will install a new Goldie & McCulloch boiler.

The town council of Amherstburg, Ont., have agreed to grant a bonus of $10,000 towards the construction of the Sandwich, Windsor and Amherstburg Electric Railway.

The council of Toronto Junction, Ont., have finally passed the agreement with the Humber Power & Light Company. The company will furnish electric energy for the town lighting system at ten cents per lamp per light, the contract to run for five years. The lights are to be in operation by October 31, otherwise all poles, wires and plant in the corporation can be forfeited. The franchise is not an exclusive one, and the town can purchase power from other sources if it is found cheaper.

The steam plant to be installed by the Jacques-Cartier Water Power Company, of Quebec, will be located in St. Sauveur, and will cost about $100,000.

For a couple of years there has been dissention between the town council of Truro, N. S., and the Chambers Electric Light and Power Company over the lighting of the streets. At the beginning of this year the chairman of the lighting committee conferred with the company and offered a certain contract for lighting by meters. The council claimed that the chairman was not authorized to close the contract, while the company claimed that he advised them that he was, and they accepted the contract. According to the supposed new contract the company have a bill against the town for the first four months of the year of $2,315.10, or an average of $576.27 per month, while the old contract was at the rate of $312.09 per month. The matter is still in abeyance, while the company is supplying light at nearly double the former price.

STORAGE BATTERIES

For all Purposes, Central Stations, Automobiles, Etc.

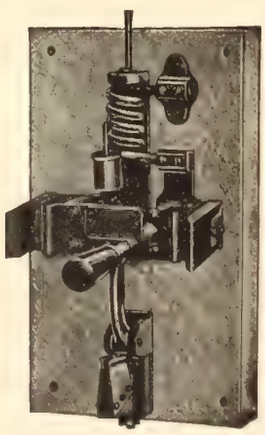
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Electric Launches
Portable Batteries

Light Weight Long Life Highest Efficiency

For Catalogue and Prices

Canadian Motors, Limited, 710-724 Yonge St., Toronto

As Accurate as an Ammeter



Westinghouse Type A Circuit Breaker.

The rapid introduction of the **Westinghouse Type A Circuit Breaker** since it was first offered for sale by us, and its remarkable success over a wide range of practical working conditions, has practically demonstrated its superiority.

Automatic and positive in action through its entire range, it is as accurate as an Ammeter.

Built in Sizes of 15 to 2,000 Amperes.

Westinghouse Electric
and Manufacturing. Co., Pittsburg, Pa.

Write **Ahearn & Soper Limited**, Ottawa, Canada.

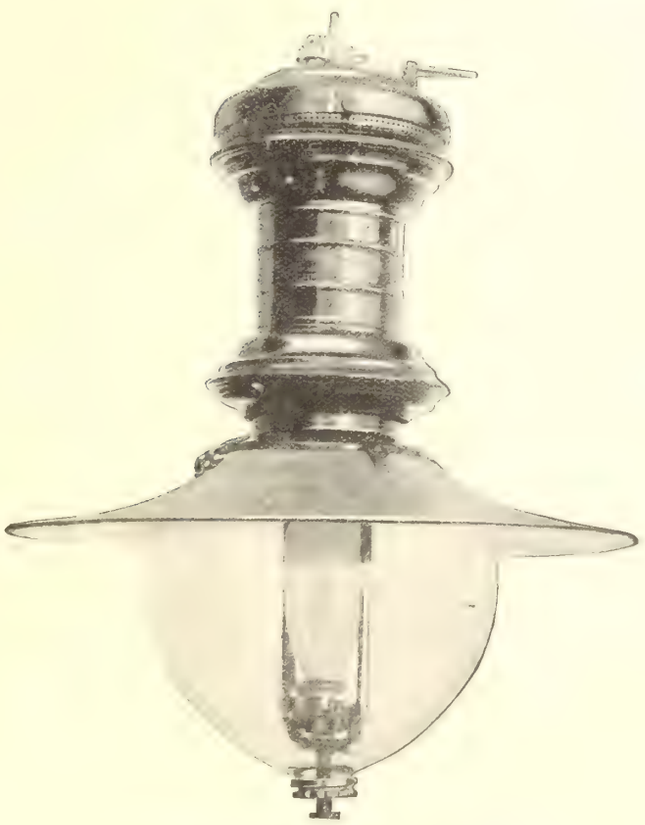
C. G. E.

SERIES ALTERNATING SYSTEM

OF

ARC LAMPS

314
Central
Station
Installations



26,000
Arc
Lamps
Installed

INTERCHANGEABLE ARC LAMP.

GENERALLY ADOPTED THOUGHOUT THE WORLD

CANADIAN GENERAL ELECTRIC CO.,

LIMITED.

Head Office: TORONTO

Use Electra Carbons

(SEE PAGE xii.)

C. G. E. Series
Alternating Arc System

IS

Automatic in Regulation
Economical in Operation
Inexpensive in Maintenance

25 to 100 Lights Capacity



60 to 133 Cycles

CONSTANT CURRENT TRANSFORMER.

CANADIAN INSTALLATIONS:

BELLEVILLE	3	Transformers	75	Lights capacity	
COPPER CLIFF	1	"	25	"	"
EAST TORONTO	1	"	25	"	"
HALIFAX	5	"	150	"	"
HANOVER	1	"	25	"	"
IROQUOIS	1	"	25	"	"
LACHINE CANAL	4	"	100	"	"
LACHINE CORPORATION	2	"	70	"	"
MONTREAL	1	"	50	"	"
ORANGEVILLE	1	"	50	"	"
ORILLIA	2	"	50	"	"
ST. HYACINTHE	3	"	75	"	"
SHERBROOKE	3	"	150	"	"

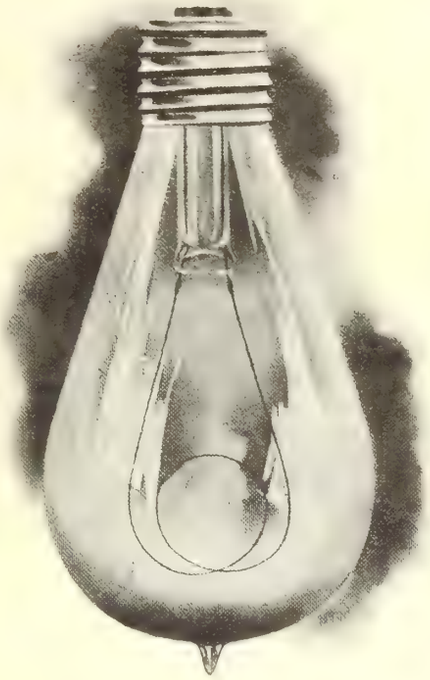
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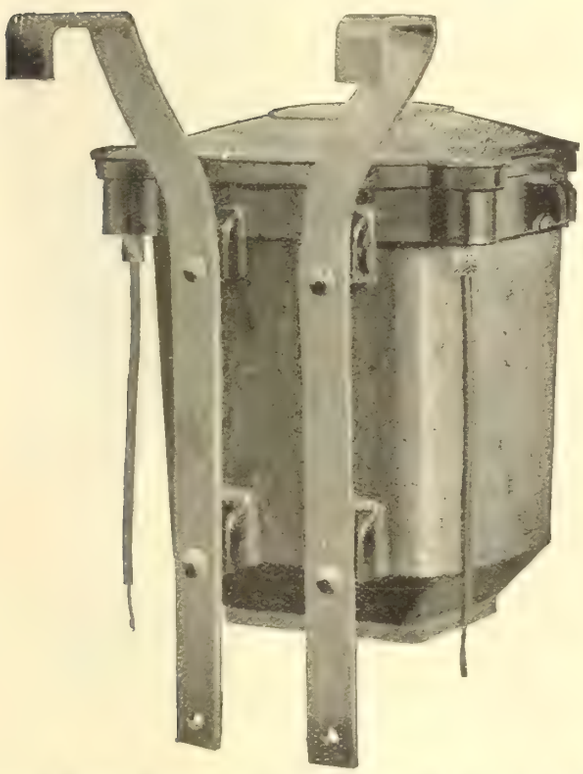
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MONTREAL HALIFAX OTTAWA WINNIPEG VANCOUVER VICTORIA ROSSLAND

Empress Lamps



Candle-Hours tell a Lamp's value in Life and Light. The Lamp which gives the greatest number of Candle-Hours is the best Lamp to use. As the "Empress" Lamp gives at least 10% more Candle-Hours than any other Lamp on the Canadian market, it is the most economical and best lamp to use.



Imperial Transformers

This Transformer, used in connection with the "Empress" Lamp (shown above) and the "Gutmann" Meter (shown below), is a combination which will earn dividends for any Plant.

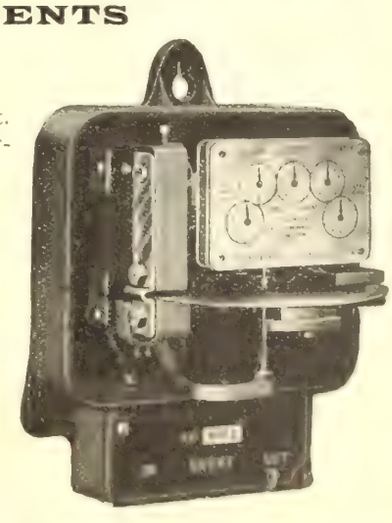
NEW GUTMANN WATT METER

FOR ALTERNATING CURRENTS



IN SHORT

The New Meter is of the sealed type.
Is correct on all loads from two per cent. of its capacity to fifty per cent. overload.
Internal losses are practically nothing.
Accuracy maintained.
Simplicity in design.
Firmly constructed.
Dust, insect, moisture and water proof.
Extremely light weight (10 lbs.)
Pleasing in appearance.
Reads directly in watt hours.
Easily installed.
No complicated parts.
No friction.



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JOHN FORMAN

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WE KEEP EVERYTHING ELECTRICAL

Lundell Fan Motors

BETTER THAN EVER

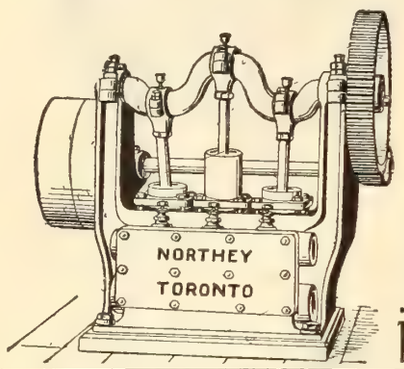
Desk Fans, Bracket Fans, Swivel and Trunnion Types, Ceiling Fans

Manufactured by the Sprague Electric Co.

WRITE FOR 1902 CATALOGUE

WATSON JACK & CO., Montreal.

THE NORTHEY TRIPLEX POWER PUMP



This pump excels in high class materials and workmanship. A practically constant delivery is assured by the three cranks being placed 120 degrees apart. The pump can be operated conveniently by water power—by belt from engine or by electricity.

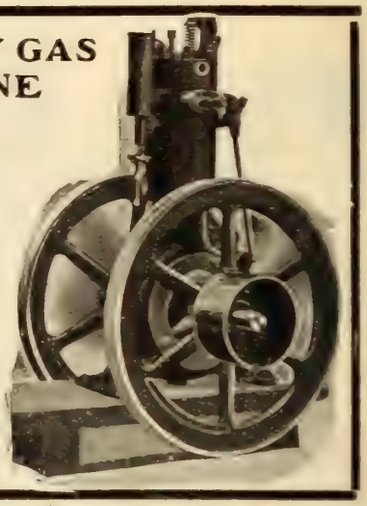
We manufacture pumps of every description—for all purposes. Our pumps are standard in Canada for excellent service.

Write for Catalogues.

The NORTHEY GAS AND GASOLINE ENGINE

The Northey Gasoline Engine offers the best proposition in the market for cheap, easily handled power. The Engine runs with practically no attention—any boy can manage it—running expenses very light. Ready for work on the minute. Suitable for running independent electric light plants—pumping and elevator plants, etc. This cut illustrates the ½ H.P. size—the only vertical style built, all other sizes are horizontal.

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THE NORTHEY CO., LIMITED. 970 King Street Subway TORONTO.



THE 1902 EDITION

STANDARD WIRING

FOR ELECTRIC LIGHT AND POWER

ADOPTED

By the Fire Underwriters of the United States.
By Cornell University, Stanford University and other Technical Colleges and Schools.
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BECAUSE

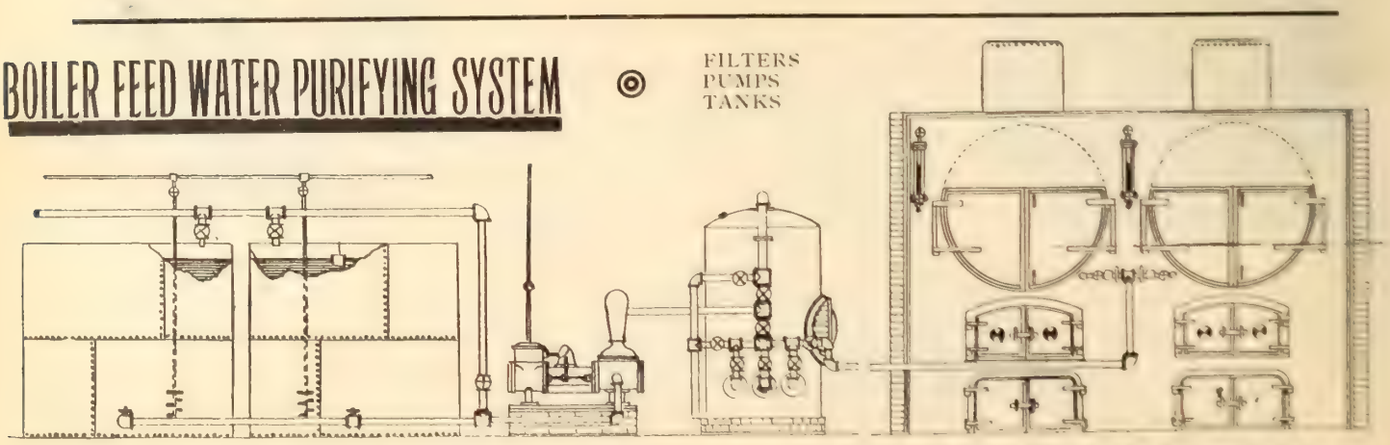
It is the only book on Wiring and Construction kept strictly up to date.
It contains all the necessary Tables, Rules, Formulas and Illustrations.
It settles disputes, and if referred to before wiring will prevent disputes.

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FILTERS
PUMPS
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JOHN McDOUGALL - Caledonian Iron Works MONTREAL, QUE.

CANADIAN
ELECTRICAL NEWS
AND
ENGINEERING JOURNAL

VOL. XII. JUNE, 1902 No. 6.

Canadian Electrical Association

THE TWELFTH CONVENTION TO BE HELD IN HISTORIC QUEBEC

THE Ancient City of Quebec is to be the meeting place this year of the Canadian Electrical Association. The convention will occupy four days, opening on the 11th and closing on the 14th inst. The programme, printed elsewhere in this number, is an interesting one. Coupled with the many attractions of the Convention City, it should draw forth an unusually large attendance of the members.

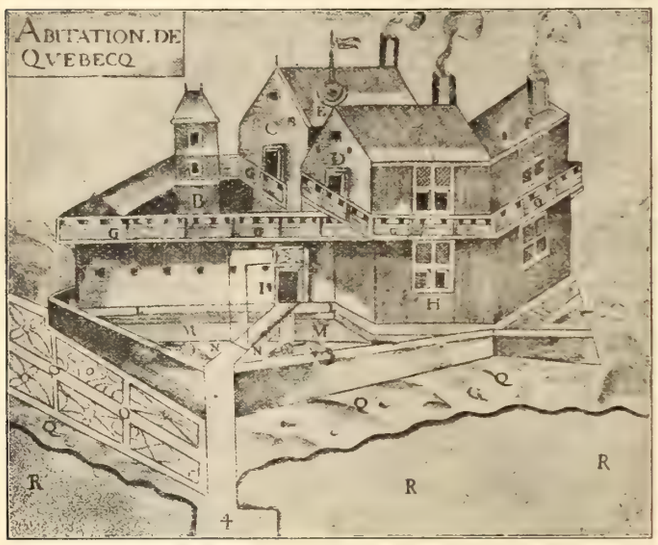


CITY HALL, QUEBEC, WHERE THE BUSINESS SESSIONS OF THE C. E. A. CONVENTION WILL BE HELD.

Quebec vies with Niagara Falls as being one of the most interesting places on this continent and is visited every year by thousands of tourists from all parts of the world. Nowhere else on this side of the Atlantic is to be seen such interesting mediaeval remains side by side with such up-to-date features as electric cars, and an abundance of electric light and power. Nothing can stand in the way of modern progress, hence some of the old landmarks have disappeared, but there remain enough to awaken and gratify the deepest interest of the visitor. Those who have never seen Quebec should not forego the opportunity of doing so under the particularly favorable conditions afforded by the coming meeting of the Canadian Electrical Association, when every facility will be placed at the disposal of visitors. Those who, by previous visits, already know something of the charm of the place, will be certain to try to pay it another visit.

The ancient city of Quebec was founded by Champlain in 1608, and remained under French rule until 1759. On the 13th of September of that year was fought the renowned battle between the French and the

British in which both commading generals were slain on the field, the British finally being victorious and resulting in Canada's cession to England. Monuments to the memories of both Wolfe and Montcalm have been erected. The British immediately turned their attention to the defence of the city, and from its commanding position and the strength of the fortifications



QUEBEC IN 1608, FROM DRAWING BY CHAMPLAIN.

since constructed, it has been not inaptly termed the "Gibraltar of America".

The view of the city, as approached from the river, is singularly impressive. The fortifiations, with their towers and battlements, frown upon the visitor from the Plains of Abraham and from the Lower Town, and there surrounds the place an air of mediaevalism which is at once novel and attractive.

The city consists of two divisions, known as the Upper and Lower Towns. The Upper Town includes within its limits the Citadel of Cape Diamond, which covers the entire summit of the promontory, embracing an area of more than forty acres. It rises to a height of 345 feet above the level of the river. The view from the citadel, owing to its great elevation, is surpassingly grand and comprehensive. The majestic St. Lawrence, alive with sailing craft of every kind, stretches before the vision in both directions. Directly below lie the crooked streets of the Lower Town. To the east are the Plains of Abraham, together with the bluffs scaled by Wolfe and his brave soldiers in the preparation for the assault that ended in victory.

The shape of the city is triangular, the St. Lawrence and St. Charles rivers forming the two sides, with the Plains of Abraham as the base. The river fronts are defended by a continuous wall on the very brow of the cliff, with flanking towers and bastions, loop-holed for musketry and pierced for cannon. On the west side a heavy triple wall, with trenches between, formerly guarded that approach, but much of it is now demolished. The numerous ancient gates, churches, colleges, and public buildings of interesting architecture, pretty private residences, together with other features of interest, give the city a distinction which is bound to entertain and please the visitor.

The surroundings of Quebec are equally as attractive as the city proper. Directly across the river is the city of Point Levis. The Isle of Orleans, a few miles distant, may be reached by ferry, and affords delightful drives. Perhaps the most interesting point is the Falls of Montmorency. The river of that name was the scene of the battle of Montmorency, which immediately preceded Wolfe's final victory at Quebec. At the falls the water pours over the cliff into the St. Lawrence, a depth of 250 feet, broadening at the edge to about 50 feet. It is here that the famous shrine of St. Anne is located.

There are numerous water falls of magnificent power near the city of Quebec. It is probable that an invitation will be extended by the Great Northern Railway Company to the delegates to the convention to inspect the power development at Shawinigan Falls, of which an illustration is shown on another page.

PUBLIC AND PRIVATE BUILDINGS.

Located on the site of the venerable Jesuit barracks is the new city hall, an imposing structure of fine architectural proportions, and built of solid masonry designed to last for ages. Facing the Basilica, it is a substantial ornament to the central business locality in Upper Town. The Court House, in its location at Louis street and the Place d'Armes, presents a fine appearance. The Parliament Building on Grande Allee is a noble provincial structure of French seventeenth century style, in the form of a quadrangle. The site of the building is superb, commanding a view of the St. Lawrence and St. Charles rivers, the Isle of Orleans, Beauport, Charlesbourg, and the wide range of the Laurentian Mountains in the distance.



CHAMPLAIN'S MAP OF QUEBEC, 1608.

Quebec is well endowed with colleges, churches, etc. The Basilica at once commands the attention and admiration of the visitor. The Grand and Petit Seminaries, Laval University, Morrin College, the Convents



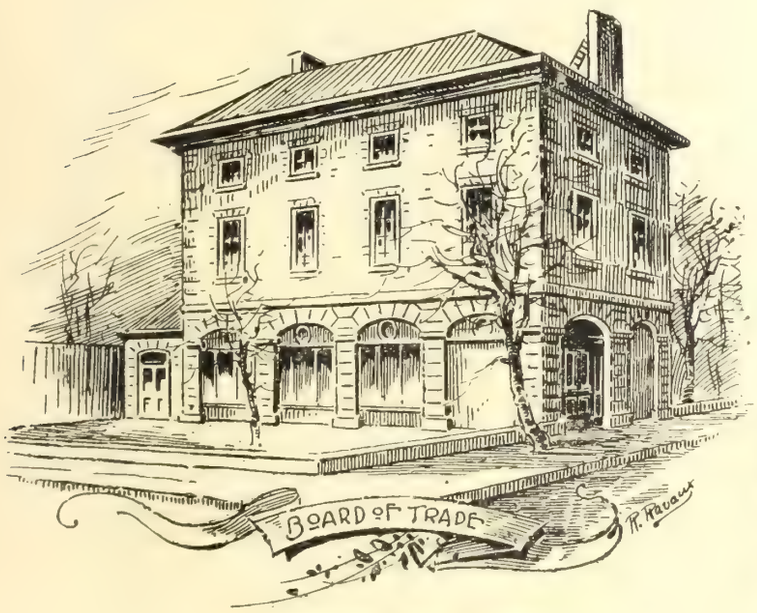
Bridge in Course of Construction Across the St. Lawrence River at Quebec

of St. Ursuline and Good Shepherd, and St. Sauveur and St. John's churches are noble seats of religious instruction and educational culture. First, perhaps, among the Protestant churches is the English Cathedral.

It must not be supposed that Quebec does not possess business establishments of first rank. This article, however, is concerned most with that which interests the pleasure seeker. A visit to the timber coves would convey an excellent impression of the shipping trade of the port.

THE QUEBEC BRIDGE.

An interesting engineering work is the Quebec bridge, now in course of construction across the St.



Board of Trade, Quebec.

Lawrence river about six miles west of the city. The site of the bridge is the narrowest portion of the river between Montreal and Quebec. The river at this point flows between high rocky cliffs, the waterway being about 1,900 feet at low tide and 2,500 feet at extreme high tide, the tidal rise varying from a minimum of 14 feet to a maximum of 20 feet. The channel is crossed with a suspended span and two cantilever arms, making an unsupported structure 1,800 feet long between centre and main piers, which is the longest span in the world. The length of anchor arms on each side of the main span is 500 feet, with one approach span of 220 feet at each end between anchor piers and terminal abutments. The total length of the structure, including abutments, is 3,300 feet.

The substructure consists of two main piers, two anchor piers, and two abutments. The north anchor pier is founded on solid rock, commonly called sillery of hard blue clay about 85 feet in thickness, containing large boulders. Both piers are of granite, backed with grit. The south anchor pier is founded on a formation



Kent Gate, Quebec.

concrete, 105 feet long by 24 feet wide at coping, and by 30 feet by 111 feet at the base, and 56 feet high from bottom of anchorage to coping or base of steel towers.



Entrance to the Citadel, Quebec.



CHAMPLAIN MONUMENT, QUEBEC, ERECTED IN 1808.



MONTCALM'S MONUMENT. MONUMENT TO THE BRAVES. WOLFE'S MONUMENT.

THE QUEBEC RAILWAY, LIGHT AND POWER COMPANY.

Of the many falls in the province of Quebec, perhaps the grandest as well as the most picturesque are those on the Montmorency. Indeed, in many persons' estimation they outrival even mighty Niagara. This is due to the fact that the water is dissembled just at the very brink and falls in one mass of white, foaming spray no less than 267 feet to the rock bottom beneath, its mad career being there checked in the peaceful bosom of the mighty St. Lawrence.

Inasmuch as these falls are only seven miles distant from the city of Quebec, one would necessarily expect to find that they had at some early date been used for industrial purposes. Such is the case, for many years ago the river was dammed up some distance from the falls, and power was supplied to run a large sawmill, the lumber trade then being and still remaining one of the chief industries of Quebec. This had its day, and gave place to the Qnebec & Levis Electric Light Compeny, which built a dam close to the falls, and by means of a wooden flume supplied water to its power house situated under the bluff, near the river side.

The Montmorency Electric Power Company, Limited, then came into existence, absorbed the old company and started a radical change, and later this company was absorbed by the Quebec Railway Light & Power Company, who carried out the changes. Meantime a cotton mill had been established at the foot of the falls, and water power to the extent of 1,000 h. p. and electricity to the extent of 600 h. p. to run its machinery is furnished in a manner as unique as it is satisfactory. This is nothing more or less than by using the remaining potential energy of the discharge water from the present power house, which is situated some little distance above the mills.

THE HYDRAULIC DEVELOPMENT.

To return, in the gradual change that has come about, an immense concrete dam has been built about 100 feet from the very brink of the falls. By referring to Fig. 1, the dam with the water rushing over its crest may be seen extending from bank to bank, a distance of 265 feet being the maximum. At the left hand of the dam is the gate house, a small wood n building, from the upper corner of which is a wing dam extending up stream 325 feet, enclosing on its shore side the head race, a body of calm, clear water. This wing dam is built of cribwork varying from 8 feet wide at the top to 20 feet at the bottom, the timbers in its construction being from 9 to 14 inches square, small granite rock filling up the spaces. Along the river bottom of this wing dam are seven apertures, varying from 12 to 20 feet in width, all being about 7 feet high. By this means all floating rubbish is prevented from entering the head race. This dam was also built to get rid of frazil ice, that bugbear to Canadian water-power development.

Frazil, that is, fine, needle-like crystals of ice, forms only in rapidly flowing water, where it has no opportunity of adhering and forming surface ice. During very cold weather some of the rapidly flowing streams become full of it, even to the consistency of thick pea soup, and should this touch any sufficiently cold body it will immediately adhere, and in a very short time form a small sized iceberg extending almost to the



very bottom of the stream. The manner in which this wing dam carries off this frazil is as follows : The swift current of the river sweeps all the frazil down stream over the dam, none passing through the apertures in the cribwork on account of there being not sufficient current there to cause it to enter. Although the current is very slow, it is not still, because there must be the same amount of water enter the head race as flows out through the pipe. This plan has been so successful that it has not been necessary to close down for an instant on account of frazil.

The entrance to the intake is in the gate house, and is protected by a heavy iron bar rack, which keeps it free from all rubbish. The intake pipe is of iron, 9 feet in diameter, reducing down to 8 feet, which is the size of the upper end of the pipe line. The heavy gate to open or stop the flow of water in the pipe is operated in the gate house by means of a rack and reducing gear. There is another gate by which a sluice in the dam may be opened if it is required at any time to lower the level of the water in the dam. The feeder pipes necessarily contain many bends, as the hillside is steep and by no means regular. The pipe is of tank steel, 2,609 feet long from the dam to the power house. It was found necessary to make some provision for the protection of the pipes from the changes in the volume of water flowing due to the opening and closing of the turbine gates, as the load on the generators should change.

It is not only for the protection of the pipe that this oscillation should be obviated, but also to allow the governors to regulate the changes of load on the generators only, and not to be affected by the fluctuation of water, the latter being a very important consideration in all water power plants where a steady service is required. It was considered that stand pipes would be superior to relief valves, and would remedy these faults. Two stand pipes were therefore erected, one being placed immediately outside of the power house, the foundation being 75 feet above the house, and the pipe 150 feet high. It is housed from top to bottom with a four-inch air space to prevent freezing.



Fig. 1, Quebec Railway, Light and Power Company—Montmorency Falls.

The other stand pipe is erected midway between the dam and the power house. It is 45 feet high, and has a counter fluctuation effect on the action of the stand pipe located lower down. It is believed that this plan has much to do with the successful engineering of this important installation.

The power house is a stone structure of two stories, 40 feet wide by 150 feet long. The turbines are called the Victor high pressure wheel, and were built by the

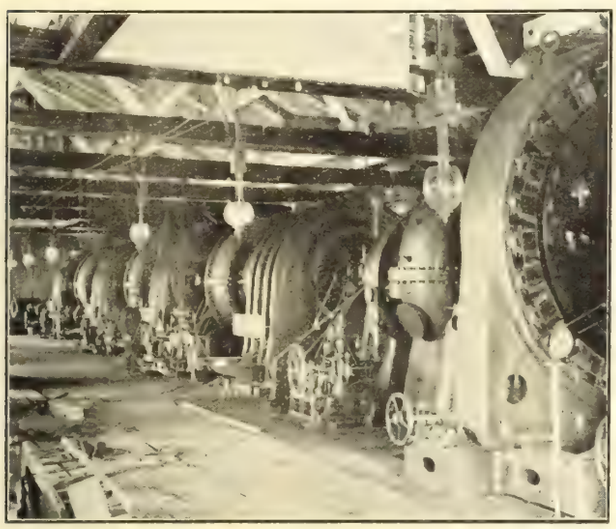


FIG. 2, QUEBEC RAILWAY, LIGHT AND POWER COMPANY—GENERATORS.

Stilwell-Bierce & Smith-Vaile Company, of Dayton, Ohio. There are five units in the plant, each having a capacity of 1,000 h. p. under a head of water 200 feet high. The wheel shaft is coupled direct to the generator shaft with flange couplings and fiber plate and bolt bushings to insure perfect insulation. For regulating the variation of speed of wheels and generators due to change of load, there is attached to each turbine a Giesler mechanical-electrical governor. At the official test made by the engineers appointed by the Quebec Railway, Light & Power Company, the turbine at half gate gave an undisputed efficiency of 78 per cent.

THE GENERATORS.

There are three 600 k.w. and one 720 k.w. two-phase S.K.C. alternators delivering current at a frequency of 66 cycles per second direct to the line at a pressure of about 5500 volts. It might be interesting to note that three of these machines were the first of that style to be manufactured by the Stanley Manufacturing Company at Pittsfield, and they have not cost one cent for repairs during their six years' operation. The other machine was built by the Royal Electric Company of Montreal, from a similar design (Fig. 2).

The fifth unit is a Westinghouse generator delivering direct current at 550 volts from one end, and two-phase alternating current from the other end. The D. C. current is used on the St. Annes Railway, which passes the power house, and the alternating current is transformed from 480 volts two-phase to 11,000 volts three-phase, and transmitted to a sub-station at St. Annes de Beaupre, where it is transformed from 11,000 volts three-phase to 385 volts two-phase, and by means of a Westinghouse 200 k. w. rotary converted to 550 volts D.C. on to the trolley of the St. Annes railway, (Fig. 3).

There are two D.C. generators separately driven for excitation purposes. The switchboard is composed of three white marble panels with polished hardwood frame. Each panel is divided into three sub-panels. On this switchboard are situated all the instruments and rheostats for regulating the machines. Here is a voltmeter indicating the voltage at the sub-station, pressure wires being run all the way back to the power house for this purpose. The primary voltage of the machines is regulated to obtain the correct reading on this voltmeter.

There are two pole lines, seven miles in length, for the sixteen wires necessary for the four 4-wire two-phase machines, on account of their not being connected in multiple at the power house. This was found to be the only satisfactory method of obtaining a perfectly uniform light in the city, as it was then independent of the greatly varying street railway load. The wires pass through a slate panel in each cupola, by means of a porcelain tubing, to the two pole lines. They are No. 0 medium drawn bare copper wires, 18 inches apart, four on each cross-arm. The two lines of eight wires each run parallel for some distance, about 100 feet apart, then branch off, and after following widely divergent lines finally converge and unite into one pole line at the bridge crossing the St. Charles river. As this river is navigable above the bridge, provision had to be made for either tunneling under the river or crossing the bridge at such a height as to clear the masts of any passing ships. The latter was decided on, and for this purpose two iron towers were built, 140 feet high, across which the wires are strung, the span being 50 feet. On account of the high winds, the distance between wires was increased to 21 inches.

The poles vary from 50 to 55 feet in height and are spaced 90 feet apart. Two barbed wires on the outside edges of the upper cross-arms, grounded at every fifth

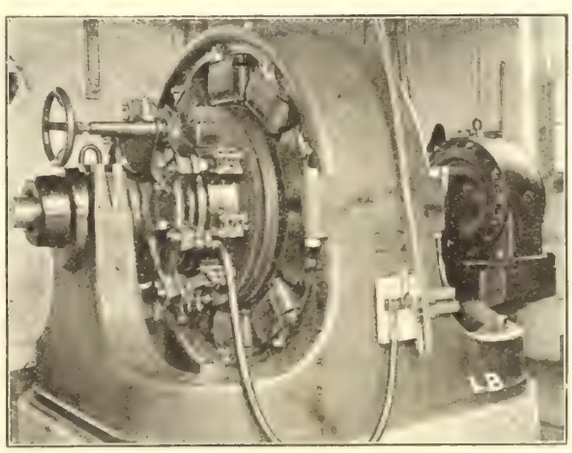


FIG. 3, QUEBEC RAILWAY, LIGHT AND POWER COMPANY ROTARY CONVERTER.

pole, together with banks of lightning arresters at each end of the line, protect against lightning.

THE SUB-STATION.

Situated on Prince Edward street, in Quebec, Lower Town, near the river St. Charles, a tributary of the St. Lawrence, is the sub-station, a handsome two-storey native limestone structure. The equipment consists of 14 100-k.w. single phase Stanley transformers, ten of them being immersed in mineral oil in a cylindrical iron case and cooled by water circulation through pipes inside the case, the remaining four being also placed in cylindrical iron cases, but only cooled by air. The water for these transformers is obtained from an ar-

tesian well sunk in the cellar 26 feet deep, from which water is pumped by means of a single-acting pump driven by a 2 h.p. belt-connected two-phase motor.

The transformers reduce the line voltage from 5,000 to 2,000 volts and may be connected in banks of three in multiple or each separately on each phase by means of the transformer switchboard. The transformers are situated in a locked room on the ground floor by themselves. On the same floor are two motor generators, two synchronous motors direct-connected to four 125-light Brush multi-circuit arc machines, and two Bullock exciters direct connected to two induction motors. These motor generators are two separate machines on separate basis, but direct-connected by means of an insulating leather coupling.

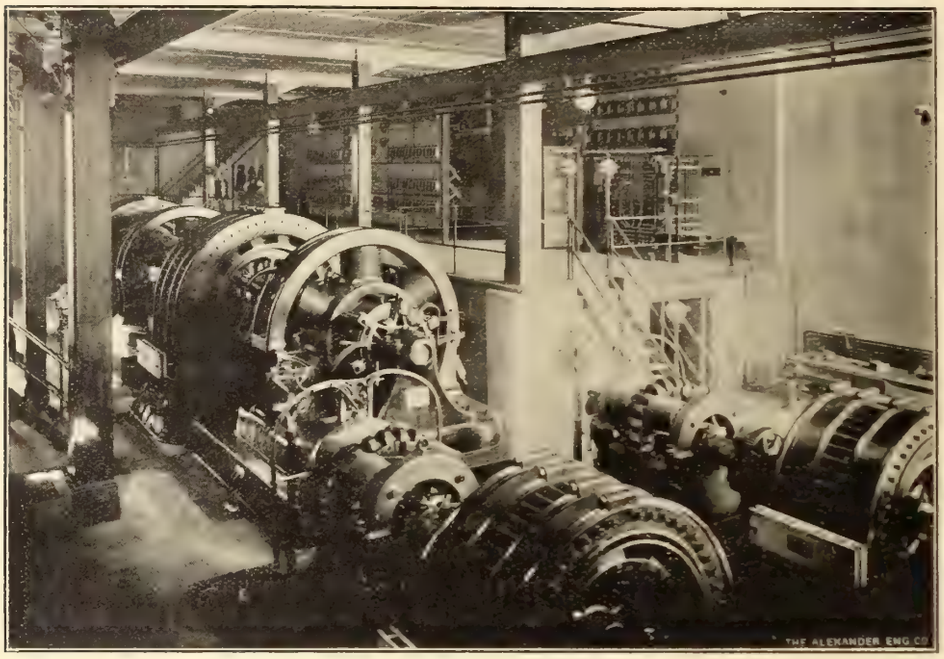


Fig. 4, Quebec Railway, Light and Power Co.—Railway Generators in Sub-Station.

The alternating side is a 600 k. w. two-phase S. K. C. synchronous motor taking current at a frequency of 66 direct from the line at a pressure of 5,000 volts and running at 286 r.p.m. The direct current side is a General Electric 6-pole 450-k. w. generator delivering current to the street railway at a pressure of 550 volts (Fig. 4) To start this machine and bring it up to the speed of synchronism, a 30 h.p. 1000 volt, two-phase S.K.C. induction motor is used, which gears with a spur wheel on the synchronous motor shaft. When in synchronism this gearing is disengaged by means of an eccentric which throws the whole motor and gear wheel away from the synchronous motor.

For arc lighting there are four 125 light Brush multi-circuit arc machines. Ammeter, headboard and regulator are placed on the machines themselves. These are driven by two 200-k.w. two-phase S.K.C. synchronous motors at a speed of 500 r.p.m., the motors taking current direct from the line at a pressure of 5,000 volts. Each motor is placed between two arc machines and direct connected to them by means of two insulating leather coverings, one on each side, as can be seen in the illustration Fig. 5. Each machine is brought up to synchronism by means of a 15 h.p. two-phase 1,000 volt S. K. C. induction motor geared to the shaft of the synchronous motor, after which the induction motor is disengaged in a similar manner as to that previously described.

For exciting the fields of the synchronous motors two 30-kw 75-volt multipolar Bullock machines directly coupled to two 30-kw two-phase 1,000 volt S.K.C. induction motors are used. Either one of these exciters is sufficient for all four synchronous motors, and also for another 600-kw unit to be installed. This makes a duplicate exciting plant.

There are six Stanley transformers situated under one of the switchboard galleries, reducing the line voltage to 1,000 for the four starting and the two exciter motors. Fuses are not used on any high tension lines.

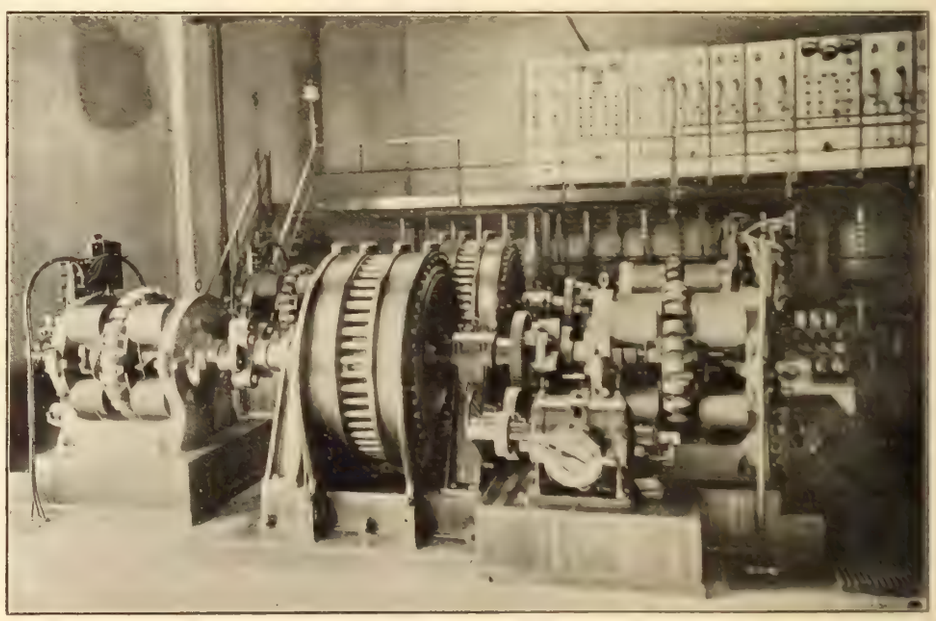


Fig. 5, Quebec Railway, Light and Power Company—Arc Machines in Sub-Station.

THE SWITCH-BOARDS.

At this substation there are five separate switchboards. The line enters the building in the tower through slate panels by means of porcelain tubes, and passes down to a small switchboard, taps being first

taken off every line to lighting arresters of the Wurts non-arcing low equivalent type. Here they are put into multiple with two rows of switches, the upper ones, four double-pole four-point break high tension S.K.C. switches of the slide type connecting to the transformer board ; the lower ones are merely plugs not intended to break the circuit, but simply to connect the line to another high tension switchboard for placing any line on the synchronous motor busses.

On each panel of the transformer switchboard, which is constructed of six panels of white marble with a polished hardwood frame, there are two transfer boards, one in order to connect any primary circuit to any transformer, and one to connect the secondaries to any set of bus-bars. This transfer board is of the socket and connecting plug type previously described. Besides the transfer boards there are also two switches on each panel, the upper being a double-pole four-point break 2,000 volt switch, the lower a four-pole eight-point break with two contacts on each side in multiple, for breaking the 5,000 volt primary connections to the transformers. These switches are all of

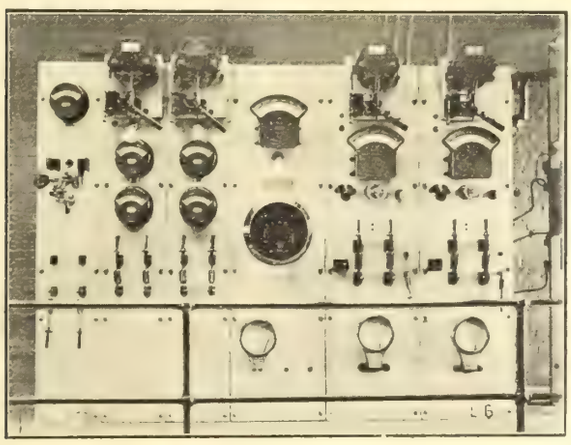


FIG. 6, QUEBEC RAILWAY, LIGHT AND POWER COMPANY—SWITCHBOARD.

the slide type, made by the Royal Electric Company, Montreal, for the S.K.C. system.

From the transformer board the secondaries run to a main switchboard on a gallery over the transformer room, a view which is given in Fig. 4. It consists of six white marble panels on a polished hardwood frame, each panel being again divided into three sub-panels. The panels on the left are for incandescent lighting only, the two on the right for power only, while the two middle ones are main and indicating panels. There are four pole double-throw switches on the middle panels to connect any machine on either the lighting or power bus-bars. Above these are situated all the ammeters and voltmeters for indicating the load and voltage. These are all of the Whitney type.

On the two lighting panels are three rows of eight double-pole double-throw switches, one for each city feeder, by means of which any circuit may be thrown on any bus-bars. At the top of the board are 8 Stanley double-pole circuit-breakers, one on each distributing circuit. The power side of the switchboard is a repetition of the lighting side, except that all the switches and circuit breakers are four pole instead of double pole.

There is also delivered to this switchboard 1,000 h. p. by the Canadian Electric Light Company from their Chaudiere power house, by way of a step-down transformer station at Levis and by cable under the St. Lawrence river.

On a gallery on the opposite side of the sub-station are situated two switchboards, one for controlling the four synchronous motors and their starting motors, and the other the street railway board. The former is a long board of 20 white marble panels with polished hardwood frame. On this board there are five panels necessary for each synchronous motor and its starting motor. Part of this board may be seen in Fig. 5, showing the arc machines. The second panel of each set of five is a transfer board having sockets and connecting plugs for placing the synchronous motor on any one of the four lines. On the upper part of the panel there are three ammeters for measuring the current on each phase delivered to the synchronous motor, and the field current.

On the lower sub-panel is the field rheostat. The first and third panels contain the main 5,000 volt switches, of the bayonet stick type, for connecting the line to one of the synchronous motors. The lower sub-panel of the first contains the synchronizing lamps and switch, while similarly situated on the third panel is a double-pole double-throw switch for exciting the fields from either of the two exciters. For synchronizing purposes one lamp only is required, but as the machines are coupled when the lamp is bright, two other lamps are placed alongside always lighted to prevent accidents, which might occur should one of the main connections be broken, in which case the synchronizing lamp would be bright and remain so. The fourth and fifth panels of each set contain the four 1,000 volt switches, also of the bayonet stick type, for the starting two phase induction motor.

Situated at the opposite end of the same gallery is the railway switchboard, Fig. 6, of six panels, also of white marble. It is practically the standard General Electric railway type, with perhaps the distinctive feature of containing a Thomson intergrating wattmeter to measure the power taken by the street railway. There are also Bristol recording instruments showing the voltage and output. The frame work under these switchboards is of iron I beams on which a slate floor is laid, while for further protection a rubber mat covers the slate floor. The railing extending the length of the boards is also insulated from the ground.

Returning to the opposite side of the station the arc light switchboard is situated at the end of the gallery, shown in Fig. 4. It is of the Brush type, built of enameled slate with connections for 12 circuits. Incandescent pilot lamps are placed immediately over the switchboard, while in the intervening space between these and the ceiling are Thomson magnetic blowout lightning arresters. A 20-ton hand crane runs the whole length of the station. All machine leads and high tension lines crossing the interior are placed in ducts in the floor, covered with neat iron plates.

Not many years ago any one who had prophesied that a street railway would be operated in Quebec would have been laughed at ; nevertheless in spite of many difficulties, arising from the heavy grades encountered in rising from lower to upper town, the narrow and crooked streets and the severe climatic conditions, the railway is operating very successfully. Sixteen miles of single and double track have been laid.

The heaviest grade is one of 15¼ per cent., with a 40-ft. radius curve at the top half, the curve being on the hill itself. Curves of 35 ft. radius are quite common, while in some places it is necessary to use a reverse curve to turn a corner. A heavy grade has been overcome in one out-of-the-way place by building steel trestle work.

Besides the street railway, the same company operate a 30 mile road that passes the Montmorency Falls and the Shrine of St. Anne De Beaupre, famous for the many miracles worked there. The cars on this road are 55 feet long and are equipped with four 50 h.p. Westinghouse motors geared for 50 miles an hour, and have Westinghouse air brakes.

At Montmorency there is, electrically operated, an elevator taking passengers up the side of the cliff, landing them close to the Kent House, at one time the residence of the King's grandfather, now a first-class hotel and pleasure resort, and run by the railway company.

Mr. A. Thomson is president, and Mr. E. A. Evans general manager and chief engineer of the Quebec Railway, Light and Power Company.

THE QUEBEC-JACQUES-CARTIER ELECTRIC COMPANY.

Perhaps one of the most interesting features in connection with this relatively young company is the great rapidity of growth of its connected capacity, and



The Quebec-Jacques-Cartier Electric Company—View of Dam and Bulkhead, Showing Flashboards on Dam.

this in spite of the severe competition it has had to contend with. A few figures to prove the above statement may be of interest. Having first started to operate in March, 1900, the connected load had already reached 800 k. w. in October of the same year ; 1200 k. w. was reached in January, 1901 ; 1600 k. w. in July, and 2,050 k.w. in December of the same year ; at the time of writing over 2250 k. w. has been reached.

THE POWER HOUSE.

The power house is situated on the Jacques Cartier River about twenty miles from the central portion of Quebec city. Water at 33 feet head is led to it through two 14-feet penstocks about 200 feet long.

The inside of the power-house is divided into three main divisions, the dynamo room occupying half of the whole building ; the lower portion of the other half contains the dynamo and exciter wheels. Above this are the living quarters of the working staff and the step-up transformers. In the dynamo room there are two Westinghouse units running at 150 r. p. m., able to carry a maximum load of 1,500 h. p., direct connected to 54 inch McCormick water wheels, and two exciters, each having enough capacity to excite both generators. These two small units are also direct connected to 18-inch turbines.

The switchboard consists of five panels, one ex-



The Quebec-Jacques-Cartier Electric Company—Power House from Bulk Head.

citer panel, two generator panels and two line panels, wired up in the standard Westinghouse fashion.

Two Lombard governors were installed, but have not yet been put in operation, fearing hammer effect in the penstocks in case of a sudden shut-down. Standpipes are at present being erected at the power-house end to each penstock. The work on these is now nearly completed and as soon as finished the governors will be connected in.

There are two sets of oil cooled step-up transformers, raising the voltage from 2200 to 22000 volts ; each set is three-phase delta connected.

The system of signaling from distributing switchboard for obtaining proper regulation is most convenient and up-to-date. It consists of instruments ingeniously placed at each end of the telephone line, but without interfering with it in the least, and by



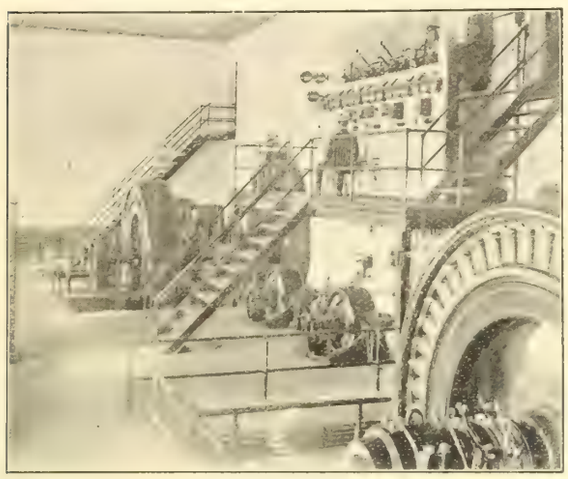
The Quebec-Jacques-Cartier Electric Company—Wheel-Room, Showing Exciter Wheel Cases and Arrangement of Valves.

means of which telegraphic signals may be sent. This is found to be much more convenient than the use of telephone for close regulation.

THE TRANSMISSION LINE.

The transmission may be divided into two parts, one, being the trausmission line proper, consisting of two

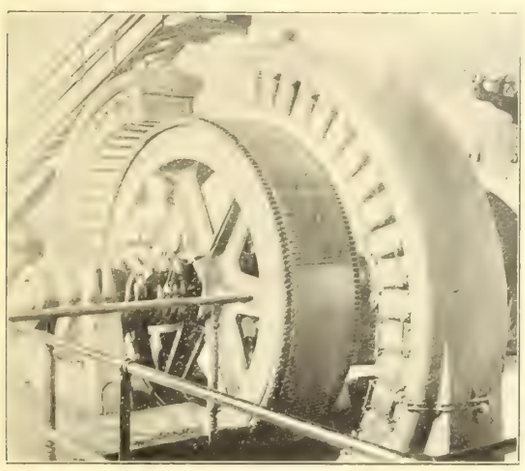
three-phase 22,000 volt lines, 18 miles in length and extending from the power-house to the step-down transformer house, which is located just outside the



THE QUEBEC-JACQUES-CARTIER ELECTRIC COMPANY—VIEW OF DYNAMO ROOM.

city limits. The wires on these lines are No. 4 hard drawn bare copper, strung 18 inches apart to form an equilateral triangle (with apex on top) on each side of the pole.

To overcome different obstacles and according to territory over which the line has to pass, various size poles had to be used ; these range from 35 to 75 feet. These two lines are protected at both ends with sets of Wurts lightning arresters arranged in the standard Westinghouse fashion. In the step-down transformer house, besides the lightning arresters just re-



THE QUEBEC-JACQUES-CARTIER ELECTRIC COMPANY VIEW SHOWING GENERATOR.

ferred to, are two sets of Scott connected oil-cooled transformers, converting current at 22,000 volt three-phase to current at 2,200 volt two-phase.

The second part of the transmission, two miles in length, consists of two two-phase 2,200 volt lines of two No. 00 wire, strung on two separate pole lines, and extends from the step-dwon transformer house to the central portion of the city, where the distributing switchboard is located. These two pole lines, although starting and terminating at the same points, follow a perfectly different route through the city.

DISTRIBUTING SWITCHBOARD AND CITY DISTRIBUTION.

The distributing switchboard consist of twelve panels of blue Vermont marble mounted on iron frame about one foot from the floor. There are three in-coming line panels, two now in operation and one spare, two regulator panels and five feeder panels. Besides these there is a panel for the power circuit and one blank. In circuit with the in-coming lines are indicating watt-meters, ammeters and recording voltmeters. The feeder panels include ammeters, recording watt-meters and a system of plugging by means of which any circuit may be put onto either phase of any line. I.T.E. single pole circuit breakers are placed on each feeder circuit on separate mountings over each panel.

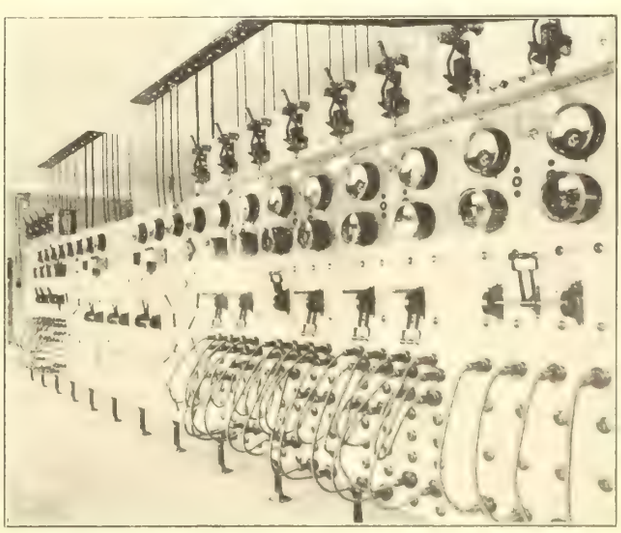


THE QUEBEC-JACQUES-CARTIER ELECTRIC COMPANY—STEP DOWN SUB-STATION.

On the two regulator panels are placed the regulators, one for each feeder. Then connected with two 350 range voltmeters, one mounted on each regulator panel, are the pressure cables which carry the pressures back to the switchboard from different points on the secondary systems.

The city is divided into several districts fed by separate single phase primary feeders (as may be noted from the description of the switchboard the power distribution is quite separate from the lighting).

In each of these districts is a main bank of trans-



THE QUEBEC-JACQUES-CARTIER ELECTRIC COMPANY DISTRIBUTING SWITCHBOARD.

formers connected to feed a three-wire secondary system (108 volts on each side). On these banks the standard of transformer used is 15 k. w., although banks or distributions with smaller size transformers exist when convenient. In the secondary distribution the three wire system is very much adhered to, being even used for service wires strung on house brackets from which several customers are fed. The outlying

districts are fed from independent transformers, most of them on the two wire system.

The company has recently moved into its spacious new quarters, where the whole of the ground floor is



THE QUEBEC-JACQUES-CARTIER ELECTRIC COMPANY—GENERAL OFFICES AND DISTRIBUTING STATION.

devoted to general offices, the appointments of which are rich and imposing. The new distributing switchboard is on the floor above the office, and also on this floor is a complete laboratory for testing apparatus and for experimentation. The engineers' offices are partitioned off from the switchboard room by means of a glass partition, so that the engineer and his assistants have a full view of the operating room. Immediately above the switchboard floor is the distributing tower composed of slate slabs, and on both sides of same are store-rooms. In the basement are the stock and in-



THE QUEBEC-JACQUES-CARTIER ELECTRIC COMPANY—CORNER OF MANAGER'S ROOM.

spector's departments, and on account of the lay of the land the back entrance opens onto the street in the rear.

FUTURE EXTENSION OF PLANT.

Having recently obtained the contract for the city lighting, the company has ordered and will shortly install all necessary apparatus. This will consist of two main units of 200 h. p., 2200 volt, G. E. induction motors. On each side of these will be direct connected one two circuit 6.6 ampere brush D. C. arc dynamo. It will also comprise a third unit of 100 h. p. with only one arc dynamo. The switchboard controlling this apparatus will be of eight panels, one for each of the motors and five for arc machines and circuits. The type of lamps to be used will be the latest G.E. direct current enclosed arcs.

Contracts have recently been awarded by the company for the erection of a steam auxiliary plant of 1800 h. p. capacity. This is to be situated outside the city limits in the neighborhood of the step-down transformer house. Three units of equal capacity will be installed, each consisting of a cross-compound condensing Robb Armstrong engine belted to a 2200 volt revolving field Bullock generator. The two 2200 volt transmission lines described above will be controlled



MR. EDWARD SLADE,
General Manager Quebec-Jacques-Cartier Electric Company.

at that end from the switchboard in the auxiliary plant. The arrangement on this switchboard will be such that by a system of plugs either line may be fed from either set of step-down transformers or from the auxiliary plant itself.

Mr. Emerson McMillan, of New York, is president of the company, and Mr. Harold Kennedy, of Quebec,



MR. L. DENIS,
Chief Electrician Quebec-Jacques-Cartier Electric Company.

vice-president. The general manager is Mr. Edward Slade, and the chief electrician Mr. L. Denis.

The employees of the Montreal Light, Heat and Power Company presented their late manager, Mr. W. H. Browne, with a beautiful silver loving cup as a slight token of their appreciation.

CANADIAN ELECTRIC LIGHT COMPANY'S WATER POWER DEVELOPMENT AT CHAUDIERE FALLS.

The River Chaudiere takes its rise in Lake Megantic, which is situated in the counties of Beauce and Compton, near the southern boundary of the Province of Quebec. Draining an area of some 2,400 square miles, it flows north, increasing in volume by the addition of several tributaries, until it reaches the falls of that name, situated about two and a half miles from where it discharges into the St. Lawrence. The catchment area being very rocky and sparsely wooded, the fluctuation in flow between high and low water is very perceptible. Previous to the development of this power, gaugings taken of the minimum annual flow indicated that 35,000 cu. ft. per minute might be depended upon. These measurements have since then been verified, showing the lowest flow to be during the summer months and early fall. The winter flow averages higher and is much steadier. This volume of water is precipitated over a cliff, forming what are known as Chaudiere Falls, a height of 85 feet, and then over rapids, a further drop of 11 feet, in a distance of about 1,000. When impounded above the falls by a dam 18 ft. high this would give a working head of 114 ft., and develop 6,000 h. p. at shafts of turbines of 80 per cent. efficiency.



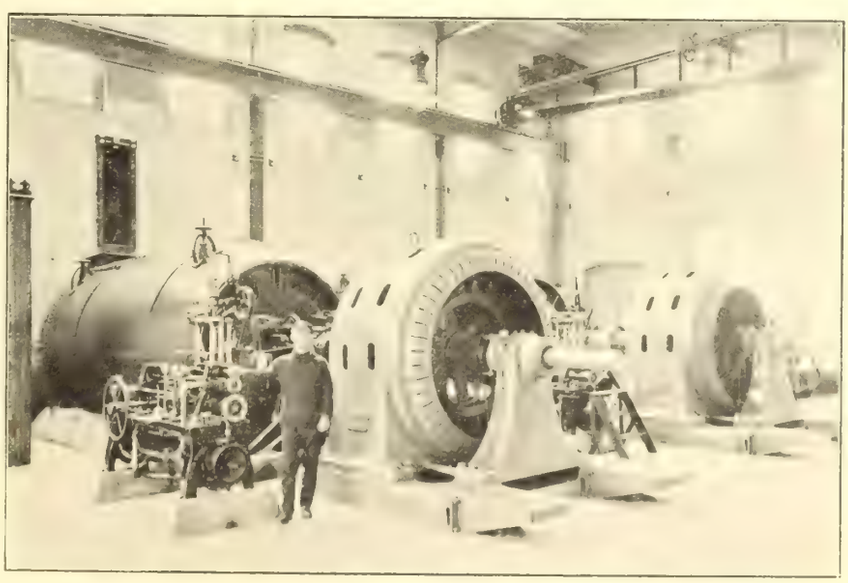
THE CANADIAN ELECTRIC LIGHT COMPANY—POWER DAM.

Having the object in view of developing and transmitting electrically this power to the cities of Quebec and Levis, for use as heat, light and power, the Canadian Electric Light Company was formed with charter rights extending over the Province of Quebec.

The services of Messrs. T. Pringle & Son, hydraulic engineers, of Montreal, were engaged to draw up the plans and specifications, and supervise the work during construction. Preliminary surveys were made in the fall of 1898, and work was commenced in September, 1899, being carried on through the winter and following summer. Current was turned on the transmission line April 2nd, 1901.

The development above the falls consists of a main dam of concrete masonry, extending across the river for 826 feet, being connected to the east shore by a heavy concrete abutment with walls 6 feet thick, carried well into the clay bank, filled in behind with earth and clay. The western end of the main dam terminates in two heavy sluiceway piers, the sluiceway itself being 12 feet wide. A wing dam joins these piers to the bulkhead, extending down stream a distance of 150 feet, forming the eastern boundary of a head race. This dam is of the same cross-section as the main dam, being 18 feet high and 20 feet broad at the base. The bulkhead, parallel to the main dam, and at right angles to the wing dam, is 28 feet high, 20 feet broad at the base, and 6 feet broad on top, being 10 feet higher than the main dam. It is constructed of concrete masonry, having built into it heavy I beam rack supports, stop log hoists, and three connections to penstocks 8 feet 3 inches in diameter. At the termination of these connections, and back of the headgates, four vertical air ducts lead to the top of the bulkhead, permitting of inlet and exit of air during filling or emptying of penstocks. The head gates in front of the penstock openings are of special design, being built of 8 inch I beams, spaced 12 inches apart, riveted to ⅜ inch plate, completely covering the whole area of the gate. The gates are constructed in two parts, the upper section, about 27 inches, being lifted first, leaving an opening 12 inches wide, permitting water to enter and fill the penstock, balancing the pressure on both sides, when the lower and larger section can be more easily raised.

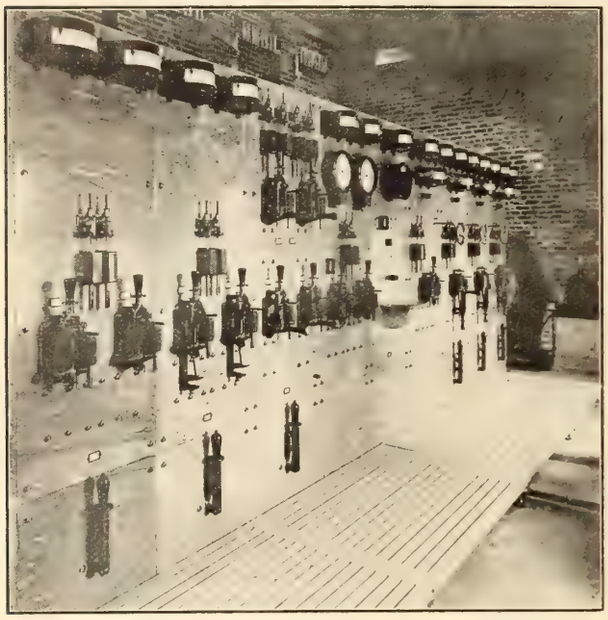
The hoisting mechanism, operated by hand, consists of a double purchase winch geared to a vertical steel stem 4 inches in diameter, having a double screw of square thread mounted between two rows of ¾ inch steel balls. From the western end of this bulkhead, and extending up stream parallel to the wing dam, a distance of 50 feet higher than the main dam, is carried an earthen embankment with a concrete core wall, connecting the bulkhead to an abutment similar to that on the east shore. Another embankment at right angles to this abutment is carried in shore a distance of three hundred feet to high ground, having a concrete core wall connecting the abutment to the bank.



THE CANADIAN ELECTRIC LIGHT COMPANY—VIEW OF GENERATORS.

The reservoir impounded by these head works contains over 70,000,000 gallons of water, and extends up stream about one mile.

Trouble from frazil and anchor ice has not been experienced at this development, partly due to the location of three small islands at the west side of the pond and in front of the head race,



THE CANADIAN ELECTRIC LIGHT COMPANY—FRONT VIEW OF SWITCHBOARD IN SUB-STATION.

deflecting the main current of the river towards the east shore, carrying the frazil over the eastern part of the main dam.

Provision is also made for the deflection of anchor and frazil ice over the main dam by five crib piers placed in front of the head race, set in such positions as to deflect ice, and also provide protection to the racks from heavy ice during spring freshets. Between these piers booms are changed to deflect debris from head race, and behind this a second boom four feet deep prevents any debris or frazil ice from lodging on the racks.

PENSTOCKS.

Provision has been made at the bulkhead for three penstocks, 8 feet 3 inches in diameter. At present but one is installed, connecting No. 1 cone in the bulkhead with Nos. 1 and 2 units in the power house. The first 160 feet from the bulkhead is nearly horizontal, there being a slight drop. It then descends the hill at angle of about 40 degrees for a distance of 140 feet, and then horizontally for a distance of about 60 feet, where it enters the power house by two elbows. The bends over the brow of the hill and to the horizontal at the foot are of a radius of about 40 feet, reducing the friction to a minimum and allowing ample room for expansion and contraction, there being no expansion joints. The courses are five feet wide, the thickness for the first 160 feet being 5-16 plate, the remaining 200 feet are of ⅜ plate. Plates are lapped at 3½ inches, double riveted throughout, the 5/16 plate by ⅝ rivets spaced 3 and 1½ inches between rows of rivets, and ⅜ plates by ¾ inch rivets, 3½ on centres and 1¾ between rows.

Saddles are provided for supporting the penstock, spaced 15 feet horizontally, consisting of 6 x 4 angles with 5″ channels braced diagonally, the angle iron being bent to fit the circumference of the penstock. These saddles are supported on concrete piers, to which they are securely anchored, the piers being firmly imbedded in the rock. Besides these piers, the penstock is anchored on the brow of the hill, and in two places on the decline by 2″ anchor bolts connected to the penstock by heavy angles and steel pins, and to anchor fox bolts imbedded in 7 feet holes with cement grouting. These tie rods are provided with turnbuckles for adjusting the strain, which is almost parallel to the centre line of the penstock.

The contract for 339 feet of this penstock was given to Messrs. Carrier, Laine & Company, of Levis, and the connection to the turbine cases and penstock to the Caledonia Iron Works, of Montreal.

POWER HOUSE.

This building measures 52x82 feet outside, the foundations being set in heavy rubble masonry, laid in cement mortar, with concrete foundations for machinery and cement floor. The walls are of brick, the roof consisting of two layers of 1½ inch pine, laid diagonally on 8x12 southern pine purlins supported on steel trusses spaced 16 on centres. These trusses are set on latticed girders, which also support the runway for a 15-ton travelling crane. The east side of the roof is provided with a large skylight. The whole building is well lighted by two rows of windows, and is fire-proof throughout, with the exception of the roofing.

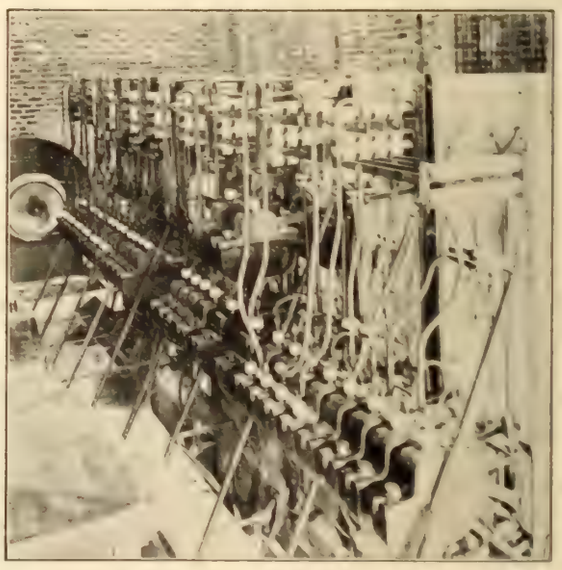
TURBINES.

The two units already installed consist of two McCormick turbines, built by the S. Morgan Smith Company, of York, Pa., having two 33 inch wheels, set with end inlet and central discharge, the buckets being of cast steel with heavy cast iron guide chutes. The dome lids are provided with adjustable water bearings and lignum vitæ steps. Each pair of wheels is mounted in a wheel case 9 feet in diameter, having a heavy cast iron head rivetted and braced to the case. The main body of the case is of 5-8 medium steel, having a tensile strength of 65,000 lbs.

Each pair of wheels is attached to steel shafts 21 feet long, 9 feet 6½ inches of which is 6 15-16 inches in diameter, the remainder being 5 15-16 inches, to which is keyed the runners which have a normal speed of 400 r. p. m. Rigid couplings are provided between turbine and generator, keyed to the shafts and forced on by hydraulic pressure. Cylinder gates controlling the water, which are operated by rods passing through the lid of the wheel case, are arranged with C. I. racks and steel pinions to receive the gate gearing of Lombard governors and provided with counter weights for balancing.

Draft tubes 29 feet long, 5 feet 6 inches in diameter at upper end and 6 feet 6 inches at lower end extending into the wheel pit, provide exit for the water. These wheels were rated at 1400 h. p., but have exceeded this guarantee under 112 feet working head, and have an efficiency of over 73 per cent. under full load.

The speed regulation is controlled by Lombard type "B" governors of the oil pressure class, having the pressure pumps on concrete floor stands on the opposite side of the shafts from the governors. As an auxiliary to these governors, and largely aiding them in close regulation under this head, two balanced relief valves are placed at the foot of the penstock, just before it



THE CANADIAN ELECTRIC LIGHT COMPANY—REAR VIEW OF SWITCHBOARD IN SUB-STATION.

s connected to the wheel cases. These valves have 15 inch pistons in a cylinder, one end of which is connected to the penstock directly. The opposite end is connected to a four inch pipe inside the penstock, extending up towards the bulkhead for 160 feet. When working normally, this "static head" pipe keeps the piston in equilibrium, the pressure on both sides being balanced. Any ram in the penstock due to a sudden closing of the gates, increasing the pressure on the end of the cylinder directly connected to the penstock, opens the valve, which remains open until the pressure has been equalized. The sensitiveness of this arrangement is controlled by check valves hav

ing spiral springs, the tension of which can be adjusted to open the relief valve under one lb. per square inch increase of pressure. These valves were built by the Lombard Governor Company, of Boston. Thi governor has operated very successfully since installation, having taken care of the machines when the full load has been suddenly taken off the generators. The generators have been operated in parallel with both governors on or



THE CANADIAN ELECTRIC LIGHT COMPANY—LAYING THE CABLE.

with one governor on and one machine operated by hand, the governor adjusting gate opening to suit fluctations in load.

GENERATORS.

Two generators are at present installed, of the three-phase revolving field type, built by the Canadian General Electric Company. These machines are rated at 750 k. w. on non-inductive load at a normal potential of 10,500 volts, with a frequency of 66⅔ cycles, and a speed of 400 revolutions per minute, capable of delivering 25 per cent. overload for four hours and 50 per cent. overload for one hour without excessive heating.

The construction is similar to the latest types of General Electric generators. The cast iron amature frame is of a strong box section, into which are dovetailed the iron punchings of the core, the windings being set in slots held in place by wedges driven over them. Ventilating spaces between the amature laminations provide for ample circulation of air.

The cast steel revolving field, weighing 13,000 lbs., has 20 projecting poles dovetailed into the steel spider. The sheet punchings forming the field poles are of high permeability. The field coils consist of copper strip wound on edge, and are insulated from the frame to withstand the regular American Institute test of two and one-half times normal voltage. The peripheral speed of the revolving element is well within safe limits, allowance having been made for an excess in speed of 30% without injurious results, the high speed permitting of a very compact design with good ventilation and lower cost per k.w. output. The total weight of each generator is about 35,000 pounds each.

The guaranteed efficiencies under different loads are as follows: Full non-inductive load, 94 per cent; ¾ load, 93 per cent; ½ load, 90 per cent; ¼ load, 83 per cent. By actual test both in the factory and at the power house these machines have shown a full load efficiency of slightly over 95 per cent. The regulation on non-inductive loads is 8 per cent. and with loads having power factors of 90 and 80 per cent. the regulation is 16 and 20 per cent. respectively. These machines show a rise of temperature of 38 per cent. after running 24 hours at full non-inductive load, and a rise of 45 per cent. at 25 per cent. overload.

The armature can be slid away from the field, exposing the coils and field windings for inspection or repairs. The sheet iron punchings forming the core are made of iron of high permeability, and no hysteresis, being japanned before assembling, and further insulated from each other by sheets of insulating paper reducing the eddy current loss. The armature coils are very carefully insulated before being put in the slots by specially prepared moisture-proof insulation not affected by moderate heat, each layer of insulation being carefully covered with insulation compound and well baked before another layer is wound on the coils. The windings are arranged so that any coil can be removed and another inserted to take its place. Insulation test of 23000 volts between coils and frame was maintained for 2½ minutes without any injurious effects.

Two exciter units of 30 k. w. are installed, each one capable of supylying full load excitation current for both main generators. These machines, of the General Electric, moderate speed, multipolar type, are direct connected to 50 h. p. McCormick turbines, having 12-inch bronze runners. Mechanical governors regulate the speed to suit all conditions of load.

The switchboard contains four panels of blue Vermont marble, with all instruments of marine black finish. Each generator has a separate panel, the exciter instruments and synchronizing lamps on a third, with two line switches and three phase electrostatic ground detector on the fourth. Triple pole oil switches, of the General Electric Company's type "K," control the current from the generators to the 10,000 volt bus-bars, and from the bus-bars to the transmission lines. These switches are capable of breaking in oil 100 amperes at 15,000 volts.

Thomson inclined coil instruments are used on this board, one ammeter per phase on each generator panel, with a voltmeter and field current ammeter. The field current is controlled through rheostats, giving a range of 10% above normal and 20% below normal working voltage. From the generators to the switchboard a three conductor, lead covered cable, insulated to withstand 25,000 volts, is run in tile ducts carrying the high voltage current. Single conductor cable connects the line switches to the two transmission lines outside the building, passing through the brick wall in 4 inch tile elbows filled with insulating compound, and having bells connected to the lead casing, preventing any injurious effects from static discharges.

Protection from lightning is through Wirts lightning arresters of the G. E. pattern, connected to each phase just before it passes through the brick wall of the power house.

TRANSMISSION LINE.

The main transmission line, extending from Chaudiere Falls to Levis—a distance of nine miles—consists of 35 ft. cedar poles,



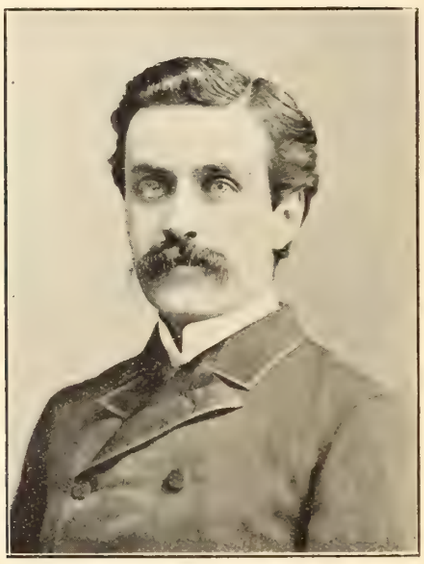
THE CANADIAN ELECTRIC LIGHT COMPANY—REELED CABLE ON LIGHTER.

7 inch top, set 5 feet in the ground about 100 feet apart, having two 4 pin, 4 x 5 pine cross arms bolted to the pole by ¾ bolts with a C.I. washer on one cross arm side and pressed washer on the other. On the top of the pole is a C.I. pole cap carrying a locust top pin. With this arrangement of two cross arms and pole cap, provision is made for carrying three circuits triangulated 18 inches apart. At present two lines of No. 4 medium drawn copper are strung, one line on triple petticoat porcelain

insulators of the Imperial type known as "Imperial No. 3", and the other on triple petticoat glass insulators. No. 6 tie wires are used, joints being of the well known Western Union type, well soldered.

Crossing the Chaudière below the power house is made on No. 1 hard drawn copper, supported on either side by towers made of four poles forming the corners of a square, having 5 x 6 double cross arms with three insulators to each wire, the wire being tied around the arm on the center groove of the insulator. The poles are given a good rake in shore and heavily guyed with strain insulators and turnbuckles inserted. The wires are 30 inches apart, the span being 420 feet, each transmission line having a separate tower on either side.

Eight feet below the transmission lines are strung two galvanized iron No. 12 telephone wires on side blocks connecting the power house and sub-station. This line is also used for signal-



HON. L. P. PELLETIER,
President Canadian Electric Light Company.

ing between sub-station and power house for voltage regulation by cutting out the telephone and using current of low voltage with signal lamps on the switchboards.

LEVIS SUB-STATION.

In this station, situated near the outskirts of the town of Levis, on the heights overlooking the St. Lawrence directly opposite the city of Quebec, is located the step-down transformers and distributing switchboard of the company. The building is of brick, 22x42, with concrete floor and transformer foundations, with a wood en roof covered with galvanized iron, and is equipped with a two-ton travell ng crane.

The two transmission lines enter the south side of the building to oil switches supported on the wall, twelve feet from the ground, connecting each line to a set of 10,000 volt bus-bars ¼x3-16 bare copper, the bars in turn being connected to four banks of step-down transformers through similar oil switches. These switches are made by the General Electric Company, and known as their type "K". The control of these switches from the board is through a system of bell cranks and levers passing between the transformers and up to the switches. By this arrangement the attendant has full control of both transmission lines and each bank of transformers without leaving the front of the switchboard.

Three banks of step-down transformers, consisting of 6 200-k. w. air blast Wagner type, connected in pairs with three-phase primary and two-phase secondary, having regulating dials on the secondary, allow a range of voltage between 2080 and 2690. The dial switches are connected to the front of the board by chains and sprocket wheels, allowing of separate phase regulation, or of regulating both phases simultaneously. These transformers being of the shell type, each coil is wound and spaced so as to give large cooling surface, and interlaced so as to reduce magnetic leakage to a minimum, maintaining excellent regulation on load of any power factor.

An air duct extends along the front of these transformers below the floor, with inlets through 12 inch circular ducts at the side of the base, the circulation passing upward between the coils to the top of the case, and is then deflected down through passages in the magnetic circuits towards the outlets into a discharge duct at the back of the base beneath the floor line. The efficiency of these transformers is as follows: Full load, 97.7 per cent; ¾ load, 97.3 per cent; ¼ load, 95.5; the regulation on non-inductive load, 1.36 per cent, and on inductive loads with 80 per cent. power factor, 3.32 per cent, the rise in temperature being 45 per cent. centigrade.

There are also installed two 150 Westinghouse oil cooled step-down transformers, Scott connected, three-phase to two-phase, with the same ratio of transformation as the Wagner type but not equipped with regulating dials. These transformers may al be worked in parallel, giving a maximum output of 2000 k. w.

The switchboard consists of nine panels, one being for each bank of transformers, equipped with ammeters for each phase, voltmeter, and four pole double throw circuit breaking oil switches made by the General Incandescent Arc Lighting Company, of New York. These transformers feed into two sets o bus-bars known as Quebec and Levis, from which circuits are led off to a distributing system in the towns of Levis, St. Joseph and St. Romuald, and two circuits to the submarine cable of the company, through which they are now supplying the Q. R. L. & P. Co. with 1,000 electrical horse power for use on their incan descent distributing system and motor circuits.

Two panels control the Levis distribution, equipped with ammeters on each phase, and single throw circuit breaking oil switches. A panel is also provided for separate control of the incandescent street lighting circuits. These circuits are operated in multiple, having separate transformers, one leg of the primary being connected to the circuit breaking oil switch, the other leg being in common between the street lighting transformers and the house transformers.

The Quebec bus-bars are connected to the trunk line through a separate panel, having one ammeter per phase, and recording voltmeters of the Bristol type, which are connected by pressure wires brought across the river through the submarine cable from the bus-bars on the distributing switchboard of the Quebec Railway, Light & Power Company. This permits of regulating the voltage on the Quebec shore through the medium of the regulating dials on the transformers. A panel is provided with electrostatic ground detector and voltmeter plug set, whereby the voltage on the bus-bars may be determined and circuits tested for grounds. The board is 18 feet long, 7 feet high, of blue Vermont marble, all instruments and switches having a



MR. G. U. G. HOLMAN,
General Manager Canadian Electric Light Company.

black marine finish. Voltmeters and ammeters are of the Wagner horizontal edgewise type. It was designed after plans made by the general manager, and built by the Wagner Electric Manufacturing Company, of St. Louis, and installed by Mr. A. C. Read, construction superintendent of the company, who installed the complete equipment of the sub-station.

Protection against lightning is provided by Wurts lightning arresters, a set being installed on both transmission lines where they enter the sub-station.

The blower set for providing air for the air blast transformers

consists of a 30 inch Sturtevant fan, belted to duplicate 3 h. p. Wagner single phase motors.

SUBMARINE CABLE.

This company are now transmitting between Quebec and Levis 750 k. w. through a submarine cable laid across the St. Lawrence opposite the city of Quebec, at a potential of of 2,500 volts. This cable was laid in order to fulfill a contract between the company and the Quebec Railway, Light & Power Company, whereby the former was to deliver to the latter 1000 electrical horse power continuously for five years. In order to accomplish this, two methods suggested themselves—one of areial suspension similar to that now employed by the Bay Counties Company, of San Francisco, across the straits; and the other of a submarine cable. The former method was the more expensive and hazardous, the distance between shores being about 4,800 feet. The latter method was therefore adopted, and has been in continuous operation since the 11th of February last, successfully transmitting current for both light and power between the two shores.

The length of the cable, laid down, is 4,350 feet, and it is composed of four No. 2-0 B. & S. gauge standard conductors and four No. 14 pressure wires, made up as follows : Each stranded conductor (composed of 19 strands of soft copper wire thoroughly tinned) is insulated with a wall of best para rubber compound of a minimum thickness of one-eighth of an inch, wrapped with



MR. P. G. GOSSLER,
President Canadian Electrical Association.

heavy rubber filled tape. The four conductors are twisted together around a jute centre, and have on the periphery between each other the four rubber covered pressure wires, the whole covered with heavy rubber filled tape and served with two layers of tarred jute.

The armor consists of 30 No. 6 B.W.G. galvanized steel wires, the outside diameter of the cable measuring 2 5/16 inches, and the weight being 6½ lbs. per foot. Before laying a pressure of 12,500 volts was applied between conductors for five minutes, and the following insulation and capacity measurements made:—

Before armoring : Actual insulating resistance per conductor, 1,003 meghoms; per mile, 835 meghoms ; actual capacity per conductor, 785 microfarads, per mile .943 microfarads. After armoring : Actual insulation resistance, per conductor, 952 meghoms ; per mile, 794 meghoms ; actual capacity, per conductor, 863 microfarads ; per mile, 1.036 microfarads. The measurements given are the average taken on the four conductors.

The cable was coiled on a flat car at the factory of the cable company, New York City, and on reaching Levis was transferred to a reel erected on board a lighter moored at the wharf. The drum of the reel was 8 feet in diameter, and equipped with winches and breaking attachments. The season of the year at which the cable was laid made the undertaking particularly hazardous. The thickness of the ice was increasing daily, making it necessary to obtain the services of the Quebec & Levis Ferry Company's ice breaking steamer "Queen" to clear a passage in front of the tug towing the lighter.

On the morning of December 11th, after waiting for two days for the river to present a favourable appearance for crossing, and with the tide just on the ebb, the procession started from the Levis shore, and in twenty minntes the lighter was moored on the Quebec side of the river. The ice in the river was from 8 inches to 2 feet in thickness, but the ice breaking steamer cleared a passage with ease, the cable being paid out from the stern of the lighter steadily and evenly as the crossing was made. The cable terminates on each shore on a terminal pole on which are mounted boxes containing lightning arresters, and cable bells four inches in diameter, filled with micanite compound, through which the conductors are brought, and connected to the respective trunk lines of the two companies. The pressure wires are connected to the bus-bars of the Quebec Railway, Light & Power Company's switchboard at their sub-station, and on the Levis side to recording voltmeters, the attendant in the Levis sub-station regulating the potential to suit the requirements of the Quebec sub-station.

On the Levis shore the cable terminal is connected to the sub-station of the Canadian Electric Light Company by four 2-0 conductors, a distance of about half a mile.

This cable was supplied by the Safety Insulated Wire & Cable Company, of New York, and delivered fifteen days from date of order. Mr. Rodier, construction superintendent of that company, had charge of the laying and connecting, and deserves great credit for the able manner in which he performed his arduous duties.

The Board of Directors of the Canadian Electric Light Company consists of Hon. L. P. Pelletier, president; H. T. Machin and Gaspard LeMoine, vice-presidents; H. M. Price, R. Audette, Charles King, Wm. Marsh, H.S. Holt and H.E. Smith. Mr. Pelletier has been connected with the company since its organization, having served on the board of directors, and for the past two years as president.

The officers of the company are G.U.G. Holman, general manager; A. R. Henry, general superintendent; A. C. Read, construction superintendent; A. Blanchet, power house superintendent; E. LeSauteur, treasurer; George Belleau, secretary. Mr. Holman was born at Talca, Chili, July 13, 1866. He was graduated from the Institute of Technology in 1889, and entered the employ of the Thomson-Houston Electric Company at Lynn, Mass. He remained with this company after its consolidation with the Edison Electric Company, serving in St. Paul, Minn., for the last years of his time. In 1892 he left the General Electric Company and took the position of railway engineer of the Mather Electric Company, of Manchester, Conn. After the panic of 1893, in which this firm failed, he went to Philadelphia, Pa., as manager of the Cheltenham Light, Heat and Power Company, where he remained for nearly six years. In June, 1899, he left Philadelphia to accept a railway position in New York, and helped to put through the Seaboard Air-line consolidation. In May, 1901, he came to Quebec, Canada, to become general manager of the Canadian Electric Light Company. Mr. Holman is a member of the Franklin Institute of Philadelphia, an associate member of the American Institute of Electrical Engineers, and a member of the Technology Club, Boston. During the past year he has been elected to the executive committee of the Canadian Electrical Association.

HAND-FIRING VERSUS STOKERS.

Comparative tests were recently completed at the plant of the T. Eaton Company, Toronto, between hand-firing with McClave shaking grates and the Jones underfeed stokers. The boiler plant at the T. Eaton Company consists of five 150 h. p. and two 400 h.p. Heine boilers. The main object of making this test was to determine with accuracy the cost to make the steam under ordinary working conditions. During the day the boilers were run to the full capacity, while during the night the load was below the rating of the boilers. The particulars of the tests are given below:

PARTICULARS.	HAND FIRED	JONES STOKER.
Date of Test.....April, 1902	21-23	23-25
Duration of Test, continuous, including night run, in hours	48	48
West Virginia Slack Coal		
Total Coal burned.....in lbs.	93,500	80,500
Total water pumped into boiler and evaporated into steam.....in lbs.	570,580	611,879
Total equivalent from and at 212°.....in lbs.	605,134	646,439
Total Ash.....in lbs.	12,295	7,941
Percentage Ash	13.1	9.87
Average Steam Pressure.....lbs. per sq. in.	110.3	116.3
Average Feed Temperature.....deg. Fah.	194.4	198.6
Average H. P. developed during entire run at 34½ lbs	366.	390.3
Heat given 1 lb. water at temp. of feed to convert same into steam at boiler pressure....B.T.U.	1024.5	1020.4
Actual evaporation per lb. coal.....in lbs.	6.102	7.60
Actual evaporation per lb. combustible...in lbs.	7.026	8.55
Equivalent evaporation per lb. coal from and at 212.....in lbs.	6.401	8.03
Equivalent evaporation per lb. combustible from and at 212°.....in lbs.	7.452	8.9
Cost to evaporate 1000 lbs. water, coal at $3.25 per ton	$0.251	$0.2023
Relative economics	100	124.3
Increased evaporation for equal fuel		24.3

C. E. A. CONVENTION PROGRAMME.

WEDNESDAY, JUNE 11TH.

9.00 a.m.—Meeting of Executive Committee.

10.00 a.m.—Opening of Convention in Assembly Hall, Chateau Frontenac. Address of welcome by the Mayor of Quebec, the Hon. S. N. Parent. President's Address. Reading of Minutes. Reports and General Business.

2.15 p.m.—Special cars leave the Chateau Frontenac to visit the sub-stations of the Quebec Jacques-Cartier Electric Company and the Quebec Railway, Light and Power Company, arriving at car sheds of Q. R. L. & P. Co. at 3 p. m., where a paper will be presented by Mr. A. B. Lambe, jr., Toronto, Ont., on "The Electrical Equipment of an Ordinary Street Car."

8:00 p.m.—In Assembly Hall. Paper: "Development of Arc Lighting Apparatus from 1810 to 1902, with Special Reference to Modern Arc Light Engineering" (Illustrated), by Mr. W. D'A. Ryan, Lynn, Mass.

THURSDAY, JUNE 12TH.

10:00 a.m.—Papers: "Arc Lighting," by Mr. C. M. Green, Lynn, Mass.; "Lightning Protection and the Static Interrupter," by Mr. Percy H. Thomas, Pittsburg, Pa.

2:00 p. m.—Special cars leave Chateau Frontenac for the Shrine of St. Anne de Beaupre, Montmorency Falls and Kent House; members will also visit the Power House of the Quebec Ry., L. & P. Company at Montmorency.

8:00 p.m.—By kind permission of Lt. Col. Wilson, R. C. A., the Royal Canadian Artillery Band will give a concert on the Terrace.

9.00 p.m.—Annual Banquet, at Chateau Frontenac.

FRIDAY, JUNE 13TH.

10.00 a.m.—Papers: "The Use of Storage Batteries in Electric Distribution Systems," by Mr. A. A. Dion, Ottawa; "Electric Suburban Railways," by Mr. Ed. A. Evans, Quebec, Que.

Selection of City for next Convention.

Election of Officers.

1.00 p.m.—At the invitation of Mr. Frederic Nicholls, 2nd Vice-President and General Manager of the Canadian General Electric Company, the members of the Association will be tendered a trip by steamer round Island of Orleans, visiting the docks, harbor and site of the new Quebec Bridge; returning to Quebec in time to connect with evening trains and Montreal steamer. Luncheon will be served on board.

Note: The general business of the Association will be transacted in the Assembly Hall, Chateau Frontenac. After page 75 of this issue was printed, the place of meeting was changed from the City Hall to the Chateau Frontenac.

DINNER TO MR. W. H. BROWNE.

The Montreal friends of Mr. W. H. Browne, late manager of the Royal Electric Company, tendered him a complimentary dinner on May 17th. prior to his departure for Great Barrington, Mass., to assume the management of the Stanley Instrument Company. The dinner was gotten up by the Knight of Columbus as a token of their appreciation of the services rendered to that society by Mr. Browne. It was likewise taken advantage of by the business men of Montreal to do honor to an esteemed fellow-citizen.

Over one hundred and fifty persons sat down to the dinner, which was held at the Windsor Hotel. The menu card was most artistic and an index to the character of the occasion. The finest orchestra in the city was in attendance, together with some of the best talent. The large dining hall was very tastefully decorated with English and American flags.

The toast list included "The King", "The President of the United States", "Our Guest", "The Dominion of Canada", and "The City of Montreal". The health of Mr. Browne was proposed by Senator Beique, who was at one time the vice-president of the Royal Electric Company. The Senator praised very highly Mr. Browne's talent. He had worked shoulder to shoulder with him in many important enterprises and could appreciate his excellent qualities. He had never met a man better organized bodily and morally for the work entrusted to him. His Worship Mayor Cochrane also spoke most highly of Mr. Browne and regretted exceedingly that Montreal was to lose a man of his character and business record. He believed that the Montreal, Light, Heat and Power Company was making a great mistake in allowing him to leave the city, as men of his ability were hard to find. The speeches of the evening showed the warm appreciation of all present for the guest of the evening, and were a fitting close to Mr. Browne's career in Montreal after the great work he had done in building up the company with which he was connected from a small beginning into a great and flourishing institution.

On rising to reply Mr. Browne met with a most enthusiastic welcome. He said he had done nothing in Montreal to justify so cordial a demonstration. Perhaps the principle he had established more than anything else was that Canadians were just as capable as were Americans. That was the principle they were really celebrating. It also showed the possibility of pursuing an honest, conscientious line of conduct in business life and being honored for it.



HON. S. N. PARENT, Mayor of Quebec.

The Western Electric Company, of Chicago, are reported to have secured the contract for arc lamps, etc., for the lighting of Montreal by the series alternating system.

An electric motor car carrying three passengers recently made the run of 486 miles—London to Glasgow—at a cost of £3 15s 3d for current and night attendance, or less than ½d per mile. Altogether, with the Glasgow trials and the return journey, the distance covered on the tour was 1,161 miles, which is probably a record for an electric carriage.

After having made trial of their capabilities, the Australian Commonwealth Government is reported to have determined to utilize motor cars for the collection of letters in all large centres. It is intended, further, to use the automobile for the conveyance of mails between the cities and the suburbs, and to introduce it for long distance carrying to outlying districts that are not served by the railways.

ELECTRICAL INSTALLATION FOR THE SOULANGES CANAL.

The Soulanges Canal, about 14 miles in length, couples Lake St. Louis to Lake St. Francis, the level of latter being about 82 feet higher than that of the former. Between the two levels only five locks are interposed, the first three having the exceptionally high lift of about 23 feet, the fourth a lift of about 12 feet, and the last a lift of about 2 feet.

The location and design of canal and locks, and superintendence of contruction, have been entirely the work of Mr. Thomas Munro, past president of the Canadian Society of Civil Engineers. His large and varied experience in canal work has led to the use of some novel features in the construction of this canal, and we understand that those best qualified to judge have pronounced it to be the finest canal on the continent.

Owing to the fact of a good water power being available on the canal, it was decided to install an electric plant for the operation of the locks, sluices and bridges, and to light the canal throughout its entire length. On account of the length of the canal the alternating current three-phase system was adopted.



OFFICE OF MR. MUNRO, Chief Engineer Soulanges Canal.



LOCK NO. 5, SHOWING STEAMER LEAVING FOR LAKE ST. FRANCIS.

The carrying out of this portion of the work was placed in the hands of the Canadian General Electric Company. The application of alternating current apparatus to work of this class being a novelty, many interesting engineering problems were encountered and successfully solved.

THE POWER HOUSE.

The power house is situated on the south bank of the canal at its point of crossing the Grease river, which is five miles from the upper entrance and nine miles from the lower entrance of canal.

The illustration gives a good idea of the general appearance of power house, designed by Cox & Amos, architects, Montreal. It is substantially and handsomely built of "Milton" pressed red brick, trimmed with buff Ohio sandstone sills and transoms. The building is two stories high, surmounted by an ornamental terra-cotta roof finished with copper sheathed turrets and trimmings. The generator room occupies the central portion of the building and extends the full width and height. One wing is used as a storehouse, and the other as a dwelling for power house attendants.

The hydraulic equipment was designed by Mr. A. M. Rice, of Dayton, Ohio. There are two wheel-pits, in each of which are installed two pairs of Victor turbines on one horizontal shaft operating under a twenty foot head at 225 r. p. m. and discharging into the Grease river, which acts as a tail race. Each set of wheels is furnished with a Geisler governor.

To each of the above water wheel units is coupled a three-phase revolving field, 60 cycle generator of 264 kilowatts capacity at 2400 volts, furnished by the Canadian General Electric Company, each being set on concrete foundation capped by heavy dressed stone. Two four-pole exciters are furnished, each of 17 kilowatt capacity at 125 volts, being sufficient to excite the fields of both generators. These are driven by belts from the main water wheel shafts.

The switchboard is of blue Vermont marble, the end being guarded by heavy brass grille work, which also extends around the top. It comprises five panels, 90 inches high, and has a total width of 12 feet. Two generator panels, each furnished with a three-pole main switch of the old break type, three ampere meters, one voltmeter, all of the Thomson inclined coil type, three expulsion fuse blocks, one voltmeter and synchronizing plug

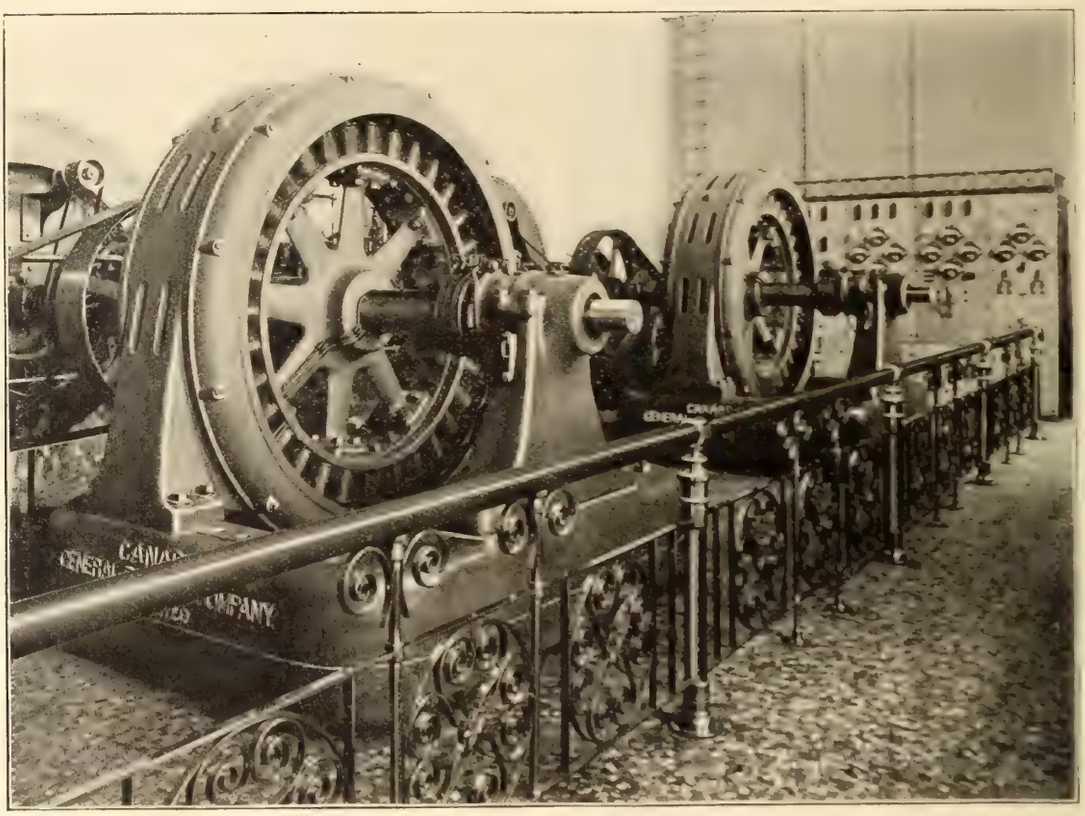


SOULANGES CANAL POWER HOUSE AT GREASE RIVER.

switches, two pilot lamps, field rheostat and switch; one exciter panel furnished with two main exciter switches, two ampere meters, one voltmeter switch, two field rheostats and two pilot lamps ; two feeder panels, each furnished with two three-pole quick break switches, one for power and one for arc lights, two ammeters, six expulsion fuse blocks, and one electrostatic ground detector.

The wiring is such as to admit of any circuit being connected to either or both machines. The cables between switchboards and machines are carried in conduit, which is covered by iron checker plate.

The lighting of the power house is carried out by means of 16 c.p. incandescent lamps, set very closely together just below steel beams which carry the travelling crane, each lamp being set at an angle of 45° with horizontal, and provided with a neat reflector. The wiring is concealed in moulding, and switches are provided to turn on the lights in sections. A hand operated travelling crane is provided of sufficient capacity to easily handle the heaviest part of generators. A novel feature of the generator room is the marble mosaic floor, which is worked into a neat and artistic pattern, also the substantial ornamental brass railing forming a passage-way down one side of the room.



Interior of Power House.

The switchboard is connected to the transmission lines by means of highly insulated lead encased cables, which pass under the canal and terminate at fuse blocks placed in a neat terminal house, in which are also located the lightning arresters protecting said cables from lightning discharges.

THE TRANSMISSION LINES.

From this terminal house four three-phase circuits emerge. The circuit to upper entrance at Coteau Landing consists of No. 6 B & S., the arc lighting circuit being of the same size. The power circuit to the lower entrance at Cascades Point consists of No. 4 B & S., and the arc lighting circuit No. 2 B & S., all bare copper wires. These transmission lines are carried on red cedar poles, perfectly straight and dressed octagonal; they were brought from British Columbia, it having been found to be impossible to obtain satisfactory timber nearer. All poles are set six feet in the ground and one hundred and twenty feet apart, every fourth pole supporting an enclosed arc lamp. The lamp poles are 35 feet high, and the others 30 feet, and all are painted with four coats of white lead. The pole line represents an unusually neat and trim appearance owing to the fact that the poles were set and plumbed by the use of the Theodolite. All four-pin cross-arms are supported by an ornamental iron brace, the design of which is shown in accompanying cut. The brackets used for supporting the arc lamps are of similar ornamental design.

It having been found necessary in a section of the canal to decrease the slope of the bank, it was deemed advisable to keep the lamp poles at a uniform distance from the centre of the canal. Two piles were therefore driven into the canal, between which the lamp poles were set and bolted, shore guys being provided to guard against mishap. From the bank to each of these poles a painted wooden platform has been erected for the use of the lamp trimmer.

The arc lamps are of the Canadian General Electric Company's multiple enclosed arc type ; the capacity is 7½ amperes, all being furnished with clear inner and outer globes. The lamp cases are weatherproof and are furnished with an enamelled metal reflector. These lamps being of the multiple type, are each provided with a thousand watt type "H" oil-cooled transformer. This extra capacity is provided to insure a large factor of safety, which precaution is adopted throughout the entire installation.

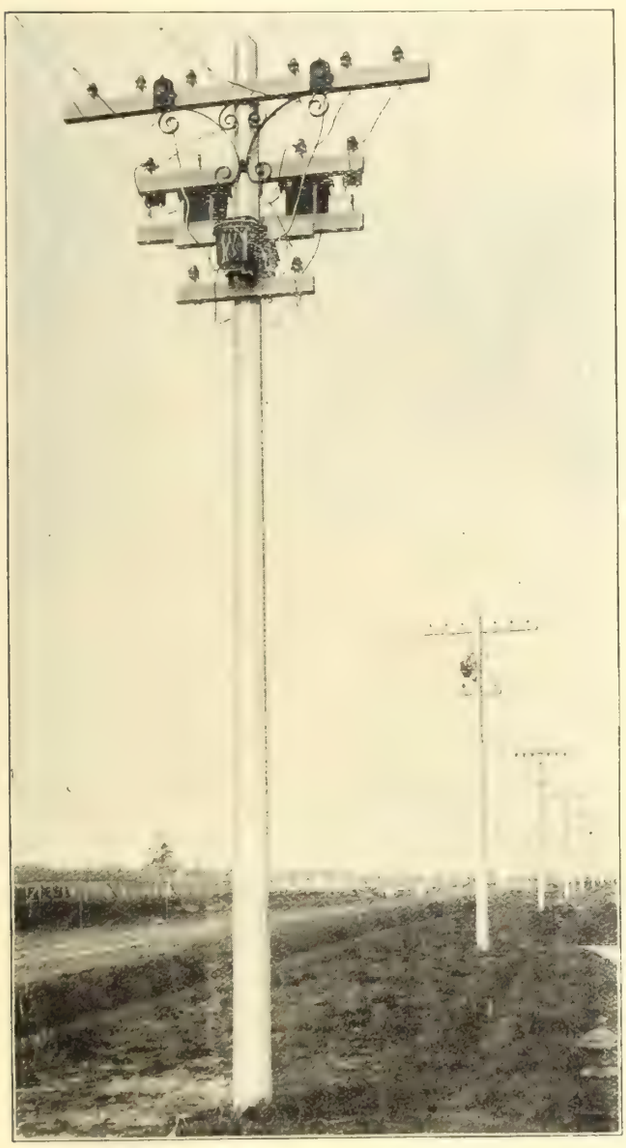
THE BRIDGES.

Crossing the canal at intervals are five electrically operated bridges. The motors and controlling apparatus are contained in a neat cabin situated on the side of each bridge. The motors are of two horse power capacity, operating at 220 volts, and are geared to the mechanism for turning the bridge. Between the electrical mechanism and the bridge gearing a flexible friction is interposed, which is operated by a lever and acts either as a clutch or a brake as occasion requires. The bridges each weigh upwards of 100 tons, and the mechanism is designed to open or close them within ten minutes. On top of each bridge a red lantern is placed exactly on the centre line of the canal, showing

both ways, as a danger signal when the bridge is closed. This lantern is lighted by a cluster of incandescent lamps. Power is conveyed to the bridge by means of submarine cables from transformers placed on one of the line poles adjacent to the bridge.

OPERATION OF THE LOCKS.

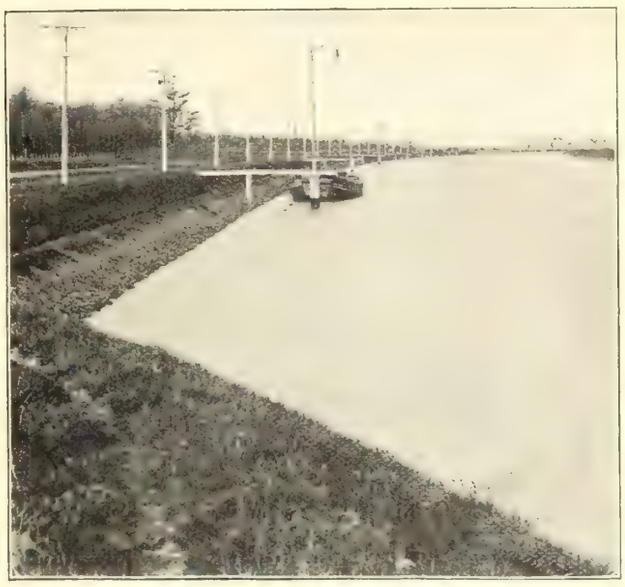
The locks are 200 feet long by 46 feet wide and are of massive concrete and stone construction. The lock gates are of particularly substantial construction and are built up of Douglas fir, which was obtained in British Columbia. The largest gates are over 40 feet high and 28 feet broad and weigh upwards of 70 tons. These gates are closed or opened by a steel I beam which has a rack secured to it, the rack being operated by a pinion. There is a recess in the back



VIEW OF TRANSMISSION LINE POLE WITH BRIDGE MOTOR TRANSFORMERS IN FOREGROUND.

wall which receives the above mentioned I beam when gate is open.

The lock gates and sluice valves are operated by Canadian General Electric Company's three-phase, 220 volt constant speed induction motors, in the following manner : The lock gate motors are of three h.p. capacity and are connected to the pinion which operates the rack by a pair of gears. At one point, however, is interposed a friction device which is so arranged that by operating a lever two friction pulleys can be brought into contact, thus applying the power to move the gate, and by reversing said lever a powerful brake is applied, which is used to arrest the motion of gate and thus prevent it striking with more than necessary force the mitre sill when closing or the recess when opening. This brake has another use, viz., that when the gates



SPECIAL CONSTRUCTION OF LAMP POLES.

are open and a vessel is passing through the same tendency is for the gates to start to close, caused by the vessel's motion; the brake being applied effectually prevents this.

That part of the above mechanism which is more intimately connected with the motor is housed in a cast iron box fitted with a rain-proof cover. The top of the box projects about 15 inches above top of coping of lock. The lever which operates the frictions is attached to a shaft which projects through the wall of box, as also does another shorter lever which operates a reversing switch used to reverse the direction of rotation of motor. The mechanism is so arranged that the power required to start motor is very small, the only friction at starting being that of a small pinion and gear and four bearings. The motor can thus be reversed in a very few seconds. This feature is of importance, as it enables the motion of the gate to be reversed with surprisingly small loss of time in case of emergency. In order that an operator can tell exactly when a gate is closed or open without specially looking



GENERAL VIEW OF LOCK, SHOWING LOCATION OF MOTOR BOXES, LAMP POLES AND SWITCH CABIN.

at it, an indicating device is arranged inside the box and an index hand passing over a scale on the outside of box shows exactly when the gate arrives at the end of its travel in either direction. The above mechanism is so arranged that the gate will open or close in one minute.

The mechanism which operates the sluice valves is of exactly the same design as that which operates the lock gates except that the motor is of one horse power capacity. The mechanism is arranged to open the sluice valves in 45 seconds.

THE SWITCH HOUSE.

The transformers which supply current to the lock motors are contained in a switch house of artistic design, as will be seen by referring to the illustration. These transformers, of which there are two, are of 7,500 watts capacity, thus allowing ample margin for large overloads on the motors. The switch house also contains a fuse cabinet which holds a fuse block for each motor and each lighting circuit. Above the fuse cabinet is arranged an enclosed switch with a projecting handle to operate same. By means of this switch current can be cut off from the entire lock. As this switch house is used by the lock operators, everything is arranged with a view to the greatest possible safety, and therefore all metal carrying current is enclosed in a substantial and effective manner. These switch cabins are lighted inside by 16 c.p. incandescent lights. Outside these houses on the side facing lock are arranged six 32 c. p. incandescent lamps in marine weatherproof fixtures. The lock motors are connected to the fuse blocks in the above mentioned fuse cabinet by means of highly insulated lead encased cables, which enter the cast iron motor boxes through brass stuffing boxes.



One of the Highway Bridges, Showing Operating Cabin and Signal Lamp.

The general lighting of the canal by arc lights is very effective, making it practically as easily navigable by night as by day. Both entrances and all locks are lighted on both sides of canal.

OTHER FEATURES.

The electrical apparatus installed along the canal is very effectively protected against lightning, lightning arresters of the Canadian General Electric Company's short gap type being installed at each lock and at every point where cables pass under the canal for lighting, power or telephone services.

In order to facilitate the operation of canal, communication between all locks, bridges, offices and power house is carried on by a telephone system, which proves to be very efficient and effective.

To provide against the cold weather which usually occurs during the first three or four weeks after navigation opens and during the last few weeks at the close of navigation, electric heaters are placed in all lock switch houses and bridge cabins. These are 750 watts capacity each. This heating system is also extended to the power house, in which a 750 watt electric heater is installed in each of the living rooms and 4,000 watt heaters in the store room. The heaters are of the Simplex Electrical Company's manufacture.

Since the operation of the sluices, locks and bridges by electricity it has been found to result in a saving of labor equal to 50 per cent., there now being required for the operation of the locks only two men, instead of four as previously.



Night View of Canal from Railway Bridge.



Parliament Buildings and Grand Allee, Quebec.



Martello Tower, Quebec.

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EDITOR'S ANNOUNCEMENTS.

Correspondence is invited upon all topics coming legitimately within the scope o this journal.

The "Canadian Electrical News" has been appointed the official paper of the Canadian Electrical Association.

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The C. E. A. Convention.

THE subjects of the papers to be presented at this Convention are of great interest and value to all companies controlling or operating electrical industries. The two papers on arc lighting will be particularly valuable at this time when there is such an agitation through this country and the United States towards changing the present systems of street illumination for others of more economical operation. The subject to be presented by Mr. Percy H. Thomas of the Westinghouse Electric & Manufacturing Co., will also be particularly valuable at this time, inasmuch as there is a great diversity of opinion as to the proper means of protecting long distance transmission lines from static discharges and efficient protection from lightning, This paper of Mr. Thomas' in itself will be well worth going a long distance to hear. It is desirable that as much information as possible be brought out at this convention in regard to the systems in use throughout this country and elsewhere for protecting long distance transmission lines as well as local distribution systems from lightning. There will be two papers on street railway subjects as well as several topics for discussion by street railway men. The papers are all of a high standard and the discussion upon them will be participated in by men of high standing in practical and theoretical work. The papers and discussions alone will amply repay attendance at the convention, and it is expected that all departments of the electrical industry will be well represented.

Steam Turbines.

The apparent success which has accompanied the introduction of the steam turbine is attracting much attention, and by many it is regarded as one of the most significant steps that has been made in the engineering field in recent years. It is claimed that it represents the coming type of apparatus for this purpose. The largest steam turbine generator yet installed on this continent is in the power station of the Hartford Electric Light Company, of Hartford, Conn. It is a reserve unit consisting of a steam turbine of about 2,100 kilowatts capacity direct-coupled to a two-phase 2,400 volt generator, this unit being intended as an auxiliary to aid the water-power plant. Steam is generated in water-tube boilers, which are fired by mechanical stokers, bituminous slack coal being used. The steam turbine is of the Westinghouse-Parsons type. Steam is admitted at the govenor valve and arrives at the chamber at the small end of the revolving part of the turbine. The steam passes along to the right through the turbine blades, passing through a series of fixed blades which deflect it in one direction, thence striking the moving blades of the turbine, which deflect it in the opposite direction, and so on. In this way the current of steam impinging upon the moving blades drives them around. The areas of the passages increase, progressiug in volume corresponding with the expansion of the steam. The turbine in question with its generator is 33 feet, 3 inches long, 8 feet, 9 inches wide, and weighs 175,000 pounds. Since the installation of the machine a number of tests have been made, which are said to show a steam economy of the most remarkable character, and an efficiency so high as to leave no doubt in the minds of those who are operating it that it represents the coming type of steam prime mover for central station purposes. It is readily started and its operation is quiet and free from vibration. It is significant that steam turbines are to be adopted by the Metropolitan Railway Company and and the Metropolitan District Electric Traction Company, of London, England. The station of the former company will contain three sets of 3,500 kilowatts capacity each, and that of the latter four sets of 5,000 kilowatts each. As with the Hartford plant, steam will be generated in water-tube boilers. These installations clearly indicate that the steam turbine has been received with favor and that it is likely to be quite generally adopted by central stations in the near future.

The time for receiving tenders for the installation of a telephone system in the city of Ottawa expired on May 20th. It is understood that the only offer received was submitted by Mr. O. W. Rogers. The city called for tenders without furnishing any specifications.

G. N. W. TELEGRAPH COMPANY, QUEBEC.

It appears that the business of the G. N. W. Telegraph Company in Quebec has been steadily increasing for the past three years, and the staff of employees has been growing larger, until there are now over fifty names on the pay rolls, and the operating room has been enlarged to double its former capacity. Two years ago there was only one "quadruplex" instrument in use in the office, and it was found sufficient for the requirements of the business. During the past three years the business has so materially improved that it has been found necessary to establish four additional quadruplex circuits.

In the last two years the company erected an additional wire between Quebec and Montreal, and another, of the largest gauge, between Quebec and Moncton, to accommodate the



MR. EDWIN POPE,
Manager G. N. W. Telegraph Company, Quebec.

traffic with the cables and with the Lower Provinces, and an additional wire was put up between Quebec and Murray Bay to improve the connection with the Government lines extension to the Straits of Belle Isle. They also completed a first-class line along the route of the Great Northern Railway to Hawkesbury, and put up another wire on the Quebec & Lake St. John Railway, to meet the rapid development of the districts traversed by those two Quebec railways. Additional wires are also contemplated for the districts east of Quebec.

The enumeration of the wires worked by the company between Quebec and Montreal is an illustration of the great facilities which it has for despatching the messages entrusted to it. On the Canadian Pacific Railway they have four wires carried by two separate lines of poles, the same accommodation on the Grand Trunk, and on the Intercolonial Railway and Great Northern Railway respectively two wires and one line of poles. There is a single line of poles and wire along the highway on the north shore, and a similar line on the south shore, making in all 8 lines of poles and 14 lines of wire.

Direct communication is had with Montreal, Sherbrooke, Hawkesbury, Ottawa and Toronto on the west, and with Bersimis, Chicoutimi, Gaspe, Campbellton, Moncton, St. John, and Halifax on the east. All the signal stations on the St. Lawrence are also in direct connection with Quebec, to the great advantage of the shipping interests.

One of the most interesting parts of the telegraphic apparatus is the battery by which the numerous wires are operated. A current from the power house of the Quebec Railway, Light and Power Company at Montmorency operates an electric motor in the telegraph building, which in turn operates two dynamos specially built for the work, and these dynamos charge some five hundred cells of storage battery. Thus the energy and power of Montmorency Falls, after various alterations, is sent out in every direction for hundreds of miles and reaches points in four different provinces.

The head offices of the G. N. W. Telegraph Company are in the "Telegraph Building," 83 St. Peter street. Mr. Edwin Pope, of whom a portrait is shown, is local manager.

THE BELL TELEPHONE COMPANY, QUEBEC.

The Bell Telephone Company's Quebec Exchange is situated at the corner of St. John and St. Angele streets. The building was erected in 1898, and the Exchange was installed in March, 1899. The switchboard is of the type known as the "Branch Terminal Multiple Switchboard," with self-restoring drops. With regard to the electrical features, commencing at the basement, the subscribers' lines enter the building in cables of 150 pairs of wires each, all cables entering the building underground. These lead covered cables are potheaded, and rubber covered flexible ends are run from the potheads to the arrester side of the main distributing rack. The rack is an open iron framework. To the arrester side of the rack the flexible cable ends from the potheads are connected, while to the other side are connected the cables leading to the switchboard. The arresters used on the main distributing rack are a combination to protect against lightning and "sneak" currents. The lightning arrester consists of two plates of carbon separated by a ring of mica; lightning or other high potential currents will jump the air gap to ground without passing through the switchboard. The "sneak" current protector is somewhat more complicated, consisting of a small coil of German silver wire, wound on a hollow brass spool, a short pin passing through the hole in the spool, being held in place by a drop of fusible alloy, the whole mounted in a rubber case. This contrivance is held between two springs. When a current greater than the switchboard apparatus will stand commences to flow in the circuit, the spool heats, melting the alloy and releasing the pin, thus grounding the line, and cutting off the heavy current from the switchboard. The two sides of the rack are connected together with jumper wires. At this rack are made all changes due to new work, removal of instruments, changes in location of instruments, etc.

Leaving the main rack, the lines pass, in cables, upstairs to the switchboard, which consists of 18 subscribers operators' positions, two in-coming trunk positions and two long distance positions. The ultimate capacity is 3,000 subscribers' lines and 120 out-trunk lines. The present equipment is 1800 subscribers' lines, 60 out-trunk lines, 30 in-trunk lines, and 20 long distance lines. The woodwork of the switchboard is polished mahogany.

The subscribers' lines and the out-trunk lines are multiplied every six panels throughout the board, so that each operator can easily reach any number in the Exchange. The multiple is carried to the long distance positions, thus doing away with a



MR. H. A. DAUPHIN,
District Manager Bell Telephone Company, Quebec.

switching operator. The in-trunk lines are controlled by signal lamps in front of the in-trunk operator.

The self-restoring drops, transmitters, lamp signals, etc., are operated from a four and two volt circuit, power for which is obtained from storage batteries. The storage batteries are connected up in multiple series, three in series, two in multiple, so as to give a difference of potential of two or four volts. The generator for charging the four volt storage battery is belted to a 500 volt, 3 h.p., two-phase induction motor. This four volt circuit is charged and discharged at the same time, the generator being

designed so as not to introduce any disturbance in the transmitter circuits while charging.

The trunk signals and pilot lamps are operated from a 20 volt circuit. The generator for charging these batteries is also driven by an induction motor. The ringing current is obtained from a ¼ h.p. ringing generator driven by a small induction motor. The machines and power circuits are controlled by an elaborate power switchboard, the switches, etc., being mounted on a polished marble slab.

The very best material and workmanship have been employed throughout, and the Exchange compares favorably with any Exchange of this discription in the world. In this Exchange and the branch in St. Roch's suburbs, which has similar equipment and apparatus, over 2,000 subscribers' wires centre, whose average calling rate is ten calls per day, or a total of 20,000 calls daily.

Submarine telephone cables laid opposite the city connect with Levis and the South Shore, while another submarine cable from Cap Rouge to Etchemin provides an outlet to New Liverpool, Chaudiere and Beauce Districts. These cables in the first instance are extremely costly, and subject to frequent interruptions from ice pressure, anchors on drifting ships and rocky river bottom, which on account of the constant tidal and current motion wears the armour away.

THE A. I. E. E.

The nineteenth annuel meeting of the American Institute of Electrical Engineers was held in New York on May 20th. The reports presented showed a net gain in membership of 239 during the year and an increase of $14,844.48 in net assets. Charles F. Scott, of Pittsburg, Pa., was elected president for the ensuing year. Mr. Scott is chief electrician for the Westinghouse Electric & Manufacturing Company and has been a member of the Institute since 1892. Papers were presented on "Some Notes on European Practice in Electric Traction with Three-phase Alternating Current," and "A Novel Combination of Polyphase Motors for Traction Purposes."



View of Shawinigan Falls, Quebec, on St. Maurice River and Great Northern Railway.



Break Neck Steps, Quebec.

Little Champlain Street, Quebec.

NATIONAL ELECTRIC LIGHT CONVENTION.

The annual convention of the National Electric Light Association was held in Cincinnati, Ohio, May 20th to 22nd. The attendance was about 550, the largest in recent years. The Canadian representatives were : Frederic Nichols, Toronto ; P. G. Gossler, W. McLea Walbank, Alfred Colyer and R. S. Kelch, Montreal ; A. A. Dion and John Murphy, Ottawa; C. B. Hunt, London.

An address of welcome was extended to the visitors by General A. Hickenlooper, president of the Cincinnati Gas & Electric Company, and acknowledged on behalf the Association by Mr. Frederic Nichols. The programme was a departure from former methods insofar as long papers on technical subjects were eliminated and short written discussions on subjects of practical importance to central station managers substituted therefor.

The president, in his address, pointed out that the greatest opportunity for increasing the earnings of central stations lay in the development of markets. He said that recently a manufacturer gave a bid on a steam turbine, direct-connected to an alternating-current generator, with a guarantee of steam consumption which would be almost equal to ten pounds of steam per indicated horse power in our old type engines. He announced himself in favor of the metric system of weights and measures and denounced municipal ownership. Ninety per cent. of all the municipal plants which had been installed had proven rank failures. Many of them had been abandoned, and many others of them would be disposed of if the taxpayers really knew the results obtained in these plants. Regarding the development of a market, the president stated that central stations only sold from ten per cent. to thirty per cent. of the amount of current they were capable of generating, and plants were practically idle for about 70 to 90 per cent. of the time. While it was not possible to acquire a daily uniform load, he thought station managers could greatly influence the load factor of their stations by the class of business they encouraged. Line, meter and transformer efficiency had often been so low in alternating current stations that the stations were paid for but from 35 to 65 per cent. of the current sent out, and even then the cost of lost current in alternating stations was not as great as the additional interest charged in direct-current stations. It was simply absurd ever to expect to develop the central station business properly as long as charges are made only on the basis of current consumed. In conclusion the president urged that more consideration be given by central station men to underground construction.

A number of short and interesting papers were read, including the following : "Performance of the Present 220-volt Lamp," by F.W.C. Bailey, Columbus, Ohio ; "Three-Phase vs. Two-Phase for City Distribution," by B. H. Behrend, Cincinnati, and C. F. Scott, Pittsburg ; "Possibilities of Sign and Decorative Lighting," by E. J. McAllister, Newark, N. J.

The afternoon of Tuesday was devoted to a discussion of lamp efficiency and lamp renewals, short contributions on these subjects having been submitted by several of the members. L. A. Ferguson, of Chicago, said that he believed that the time was coming when an eight candle-power lamp would be the standard in this country rather than the sixteen candle-power. There was a discussion on the "Nernst Lamp," "Steam Turbines," "Hot Water vs. Steam Heating," and other subjects.

A visit was made to the new factory of the Bullock Electrical Manufacturing Company, situated in a suburb of Cincinnati. It was decided to hold the next convention in Chicago in May, 1903. Lewis A. Ferguson, of Chicago, was chosen president of the Association, and P. G. Gossler, of Montreal, was elected as a member of the Executive Committee.

A new scale of membership was adopted, to take effect in January, 1903. All members admitted after that date will be required to pay an initiation fee of $25. Annual dues after that date will be fixed as follows : For members from cities having 20,000 population or less, $10 ; 20,000 to 300,000, $25 ; over 300,000 $50.

The Consolidated Electrical Company, of Toronto, is arranging for a factory at St. Catharines, Ont. The company have a capital stock of $100,000.

Laborer (waving flag)—"Yez'll hav ter turn back. This sthreet's closed." Driver—What's it closed for?" Laborer—"Bekase it's jist been opened be the tillyphone company ter put down their wires. That's why it's closed."—Philadelphia Press.

MONTREAL

Branch office of the CANADIAN ELECTRICAL NEWS,
Imperial Building,

MONTREAL, MAY 24TH, 1902.

The late strike, in which an attempt by a Union to get increase of pay, shorter hours, and a recognition of the Union, proved a disastrous failure. No doubt some of the "outside construction" men had grievances in the way of pay, they claiming that as the city paid $1.50 per day for snow-shovelling, that anything less was not commensurate pay for climbing poles among 2000 volt live wires, etc. Further, that men doing similar work got better pay in other cities, such as Toronto. Some employers retort that no other city but Montreal, which is noted for its municipal extravagance, would pay $1.50 for shovelling snow. Be that as it may, the strike was badly advised, badly handled, and totally unnecessary, in fact was like 99 "strikes" out of 100, "bungled". However, as the men have gone back to work it is to be hoped that the companies will now investigate the wages question and prove the foregoing remarks. The nine hour clause, it is to be earnestly hoped, will be put in force soon by all, not only to benefit the employees but also the employer, but, mark you, not necessarily at 10 hours' pay for 9 hours' work.

The union agreement, to which signature was properly refused by companies and contractors alike, was simply preposterous. No business man or corporation could expect to run (except into insolvency) unless by managing their own affairs. The laborer is worthy of his hire and can surely obtain it some way without putting the general public to the discomforts of a "strike".

During the strike it was wonderful to see the interest the civic fathers took (suddenly) in electrical workers. A vote is a vote !

Tenders are in for an electrical pumping plant for Montreal upper reservoir pnmping station, and at this juncture it behooves some wise acre to rush into the daily press to say that a 500 volt series D. C. motor run off a trolley in some New Brunswick hamlet was a failure and for Montreal to beware! It did not prove a success pumping municipal water, hence Montreal's will also be a failure. We happen to have a motor, and a good big one too at that, doing just such work already.

The underwriters have notified all cold storage people in Montreal that they must either put their wiring in conduit or submit to an extra 25 cents per $100 on insurance, besides being inspected every three months. Although cold storage wiring is proverbially bad, this action seems rather drastic, being the outcome of a fire at a cold storage warehouse, caused, however, by transformer breaking down and throwing 2000 volts into the building. What if some owners go back to coal oil stable lanterns? Are they not more dangerous?

Montreal is speaking of having its streets sprinkled electrically, i.e., by the Montreal Street Railway Company, instead of by the present primitive one-horse water carts. Quebec has done this for some time, the Quebec Electric Railway Company having some cars specially adapted for the work. Montreal, although to the fore in many matters, is considerably behind Quebec in this one.

There is an extensive but yet unfilled demand for an alterating current fan motor of small type for private house and sick room —one that will not give much wind; will run noiselessly at slow speed, so that if need be can be left running all night without keeping its owner awake. Some of the manufacturers of the excellent office fans now on the market might give us one more step in the speed control to suit above requirements.

The following persons known to the electrical fraternity were in Montreal recently: Mr. John Carroll, former manager Eugene F. Phillips Electrical Works and now representing Stuart, Howland & Company, of Boston, and the New England Electric Manufacturing Company, also of Boston; Mr. P. H. Hover, representing New York Insulated Wire Company; Mr. H. W. Biiven, representing Western Electric Company, New York; Mr. H. E. Monk, representing W. R. Ostrander & Co., New York.

It is not like usual Yankee astuteness to flood the Canadian electrical trade with circulars and price lists of Canadian and India mica. The former, naturally, we can procure, with extreme facility, although our U. S. neighbors do control two or three of our mines—"there are others". As to India, surely England is our better market for such, not to speak of the chances of preferential tarriff applying also.

Surely there is an opening in Canada for one of our various rubber companies to turn out "decent" hard rubber such as can be turned up and used for electrical purposes.

LINING UP SHAFTING.

By Joseph E. Lewis.

The following method of lining up shafting seems to be known by very few engineers: Referring to Fig. 1, A is a straight-edge, which may be made from a piece of pine board about 4 feet long. It must be rigidly supported by uprights, from the floor, or otherwise, as is most convenient, so that the top is at the height of the centre of the shaft. Bring the straightedge to the true horizontal by the use of a spirit level and fix it securely in place. For short lines of shafting it may be located at one end, for long lines at the middle. On each rafter that supports a hanger, nail a short stick B, with one nail, so that it may be swung up out of the way when not in use as shown in Fig. 2. The bottom ends may all be brought into line by



Fig 1 Fig 2

sighting carefully along the straightedge. For long lines sight in both directions from the middle. The ends of these sticks will also lie in the same horizontal plane at the height of the center of the shaft.

The hangers may now be put up and the shaft placed in position and adjusted to the true level by testing each bearing. For this purpose the sticks B may be turned down as shown in Fig. 2, and the center of the shaft brought to the level at each bearing. This may easily be done by the eye. To test the result, a small spirit level may be laid across the top of the shaft and a line drawn on B as shown. The distance from the end of this line to the end of B should be just one-half of the diameter of the shaft. The sticks should be turned up out of the way and left where they are, so that the alignment may be tested at any time.

Having adjusted all of the bearings to the same horizontal plane, we may now test them on the vertical plane. This is easily accomplished, whether the pulleys are in position or not. We will suppose that they are, and that the shaft varies from 3″ nominal, at the middle, to 1¼″ at the ends. Take two pieces of string and tie a nut to each end of each piece. Throw one piece over the shaft near the bearing at one end and the other piece at the other end. See Fig. 3. Now stretch a stout cord C from one end to the other, low enough down to clear the pulleys. The end of the cord should be brought exactly central between the two ends of the string hanging over the shaft. The weights may be kept from vibration by allowing them to hang in a pail of water. A small pail of oil is better yet, since its great viscosity more readily checks any motion. Having pulled the ine C taut in the correct position, it is an easy matter to adjust each bearing by throwing the string with the nuts on the ends over the shaft at the bearing to be tested, and adjusting the set screws until the line C is exactly central between the two ends of the string. You will notice that variations in the size of shafting do not hinder this operation in the least as is the case when a line is stretched at one side and attempts are made to measure in from it to the shaft; and furthermore the presence of the pulleys is no objection whatever. Any shaft may be tested in this manner during the noon hour, except when the belts interfere with line C. Where this is the case sufficient time must be allowed to remove such belts as are in the way.

If the shafting was put up with sticks, as above explained, it may also be tested for the horizontal plane in a very few moments. If the sticks are not in position, and it is desired to test the alignment of a shaft already

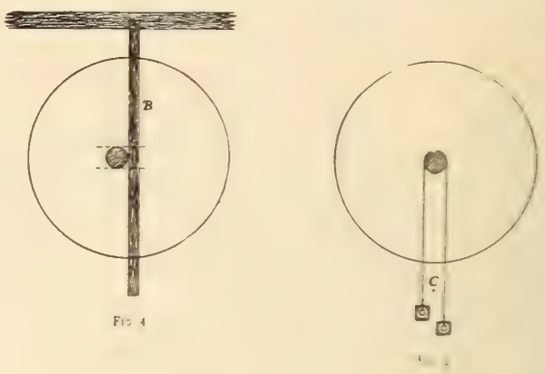
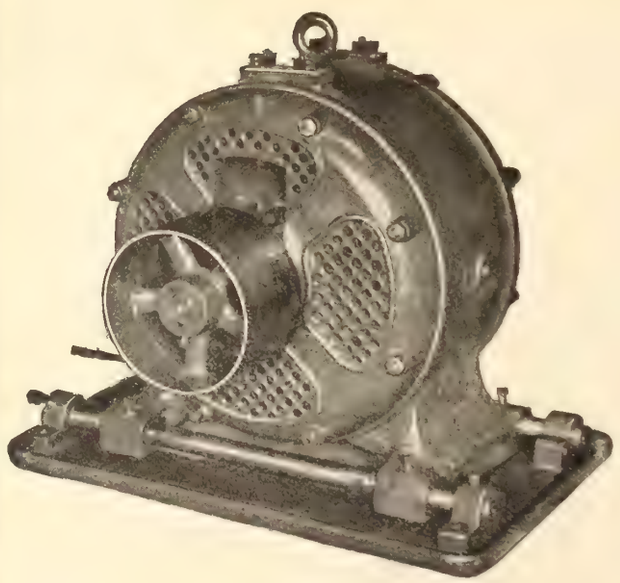


Fig 4

up, it is possible to run the line below the pulleys in the manner shown by Fig. 1, the ends of the sticks B being brought down to this plane. Now, starting at any bearing the exact center of the shaft is marked on the stick. To be accurate a small spirit level may be used to mark across top and bottom, see Fig. 4, and the space thus marked off divided in half to get the exact center. Measure carefully the distance to the end of the stick from this center line and cut a measuring stick to just that length. Use this to make a simila. line on each of the other sticks B. One of these sticks will be located at each bearing and the center of the shaft may be readily brought to the line. All of the sticks may now be sawed off the right length and swung up out of the way for future use.



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ROPE DRIVING.

The transmission of power by means of ropes running in grooved wheels has made considerable progress of late years. The system is low in first cost, and is particularly useful in conveying power to various points from the same centre. The great drawback to their use arises from the difficulty of obtaining an equal tension on all the ropes, some being strained, whilst others are performing their fair share of work.

During the last few months the writer has been consulted by several firms who have introduced rope driving as to difficulties they have encountered from ropes flying off, &c., and in each case it has arisen from the system not being properly designed and arranged in the first instance; consequently, a few general remarks on rope driving may be of interest.

Driving Centres.—Ropes will transmit power much better when arranged to run at long centres, and in comparing ropes with flat leather belts for conveying power considerable distances the balance is undoubtedly in favor of ropes, but when shafts are near together, say, 20 ft. or under, and the pulleys less than 4 ft. diameter, the advantage is in favor of belt driving. Ropes have been worked up to between 300 and 400 ft. centres when supported by idler pulleys, but this is, of course, exceptional. The slip of ropes is about 0.33, and leather belts working under similar conditions 0.96.

Material of Ropes, &c.— The driving ropes are usually made of cotton, manilla, hemp, leather, or wire. For most purposes cotton ropes are to be preferred; they should be of the best quality, and firmly and solidly made. Pure Egyptian throstle yarn, without weighting material, can be recommended. The lower side of the ropes should be the driving side, and a moderate amount of "sag" should be allowed on them, and when first put on they should be stretched as equally as possible. Cotton ropes are more pliable than those made of hemp or manilla. In splicing a rope the splice should be about 60 times its diameter. Ropes should be as elastic as possible, but lubricant should be used very sparingly, or there will be an excess of "slip".

Diameters of Ropes and Pulley.—It is of the utmost importance to secure successful working that the diameters of the ropes are properly proportioned to the diameter of the pulleys. Ropes of a moderate diameter are to be preferred to larger, as the friction of working and from bending and unbending is reduced in proportion. For like reason the driving pulleys should be of as large a diameter as may be convenient, say, not less than 30 times the diameter of the driving rope. Combe adopted the following minimum diameters of pulleys for the various sizes of ropes :—1¼ in. diameter of rope, 3 ft. diameter pulley, ratio 1 to 28.8 ; 1½ in. diameter of rope, 4 ft. diameter pulley, ratio 1 to 32.0 ; 1¾ in. diameter of rope, 5 ft. diameter of pulley, ratio 1 to 34.0 ; 2 in. diameter of rope, 6 ft. diameter pulley, ratio 1 to 36.0. The ratio of pulleys to each other should not be greater than 4 to 1, but 3 to 1 is better practice.

Speed of Ropes.—A good average speed for economically transmitting power is from 3,000 ft. to 5,000 ft. per minute. Ropes are often run faster than this, but we fail to see any corresponding advantage, as any gain inpower is counteracted by increased wear to ropes and bearing, and the centrifugal action, or tendency of the ropes to fly off, is also increased.

Rope Grooves in Pulleys.—Another very important matter in effective working is the proper construction of the grooves carrying the ropes. The general consensus of opinion is in favour of grooves formed with straight sides at an angle of about 40 to 45 degrees. The grooves should be of sufficient depth that the ropes cannot rest on the bottom. Grooves are sometimes made with curved sides, but these are not to be recommended, as the ropes cannot bed themselves properly, and have a tendency to roll round, and, consequently, more rapidly deteriorate. Grooved wheels made of wood largely increase the driving power of the ropes.

Shafts Close Together, &c.—Although ropes do not give the best results for driving shafts which are close together, they are sometimes used. In this case a single continuous rope is often employed, the rope being laced backwards and forwards from one groove to the other, a tension pulley being employed for leading the rope from the last groove into the first. For keeping the ropes from flying off an idle grooved tension pulley is sometimes employed.

Crossed Vertical and Angular Lines.—This form of driving

The New Type "G" Scheeffer Recording Watt Meter

IS NOW READY FOR DELIVERY.



We are now manufacturing in our factory at St. Catharines, and have ready for delivery, the new Type "G" Scheeffer Recording Watt Meter.

Type "G" has all the advantages of the Scheeffer Type "E" meter, with several new features.

It is the lightest and smallest meter on the market.

It has a wide range of adjustment.

It is correct on pressure balance so that there may be absolutely no movement when current is not being used.

It is so arranged that when putting up, connections are very easy to make.

It is provided with sealing disc and means of sealing, in conformance with government regulations.

It is the most sensitive meter on the market. Experts who have tested it state that Type "G" is the only meter which will record the consumption of current when a single HYLO Lamp is burning on its one candle power filament.

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Sole Manufacturers



should be avoided wherever possible, but if absolutely required special forms of grooves are necessary, and for right angle drives a pair of additional specially arranged horizontal guide pulleys are required. For successful vertical driving extra ropes are required, as the ropes have a tendency to fall out of the grooves. Ropes convey power best when worked horizontally, or at an angle of about 45 degrees.

RENEWING ROPES.—Ropes should be renewed, as far as possible, altogether, as it has been found in practice that if new ropes are put on to work with old ones that the new ropes brake the old ones till they are all rubbed down to the same size. To get over this difficulty, in America a single continuous rope is often employed.

ROPES FLYING OFF DRIVING WHEELS.—Some of the chief reasons for ropes flying off may be stated as follows:—(1) Improperly proportioned driving wheels and ropes, (2) excessive speed, (3) too short driving centres, (4) a suddenly applied load, (5) too powerful an engine for the work, (6) too early a cut-off, or too much "cushioning" in the engine. If an engine has a fairly full load, and other things being equal, the jumping of ropes is usually not much, but if the power of the engine is larger than is generally required, and the slide valve is set to cut-off early, when the steam is turned on great stress is immediately put on the tight side of the ropes, which causes the slack side to fly up suddenly.

TO FIND THE HORSE POWER TRANSMITTED BY ROPES.—Rule. Multiply the sectional area of rope in square inches by 100 times the speed of the rope in feet per minute, and divide by 33,000, which will give the horse power (approximately) transmitted by each rope.

TO FIND THE INDICATED HORSE POWER TRANSMITTED BY ROPES.—Rule. Multiply eight times the square of the circumference of one rope by the number of ropes, and by the circumferential velocity of the driving pulley in feet per minute, and divide the product by 33,000.

ADVANTAGES OF ROPE DRIVING.—Amongst the advantages claimed for properly arranged rope driving may be mentioned low first cost and cheapness of repairs, and freedom from serious accidents. Power can be conveyed from the fly-wheel direct to various floors,and shafts that are not quite parallel may be readily driven.—M. Powis Bale, M. I. M. E., in the Timber Trades Journal.

TELEPHONE POLES FOR SALE

The undersigned have in stock, and ready for shipment, 5,000 Cedar Telephone Poles, in all lengths from 25 to 65 feet. Prices given on application for lots of one carload or more, f. o. b. here, or delivered at points required in Canada or United States.

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SPARKS.

The North Sydney Electric Light Company, of North Sydney, N.S., have decided to sell their plant and franchise to the Cape Breton Electric Company for $40,000.

A syndicate represented by Mr. H. D. Symmes has been granted a franchise to supply electric light and power in the village of Niagara Falls South, Ont.

Mr. Clemens Herschell, one of the greatest water power experts in the world, has given advice regarding the turbines and wheel-pit to be put in by the Canadian Niagara Powe Company at Niagara Falls, Ont. Mr. Herschell will suggest changes in the original plans of the wheel-pit for the better working of the turbines.

It is reported that the Canadian Pacific Railway Company have in view the erection of a central electric power house at Fort William, Ont., of sufficient capacity to operate the grain elevators and furnish light for docks. At present the company's works are lighted by the municipal plant, which has almost reached its maximum capacity.

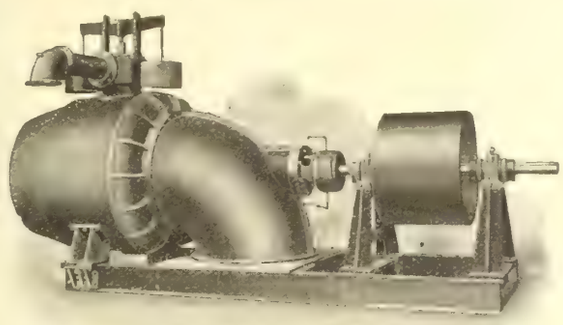
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Victor Turbine

On horizontal shaft is shown by the cut herewith. The water is discharged through one end through the draft tube, and in this case the usual end thrust connected with single wheels is entirely provided for.

The Victor Turbine is Built

upright or horizontal, single or in pairs, and in a variety of styles to meet the requirements of almost any situation.



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Air Pumps, Vacuum Pumps,

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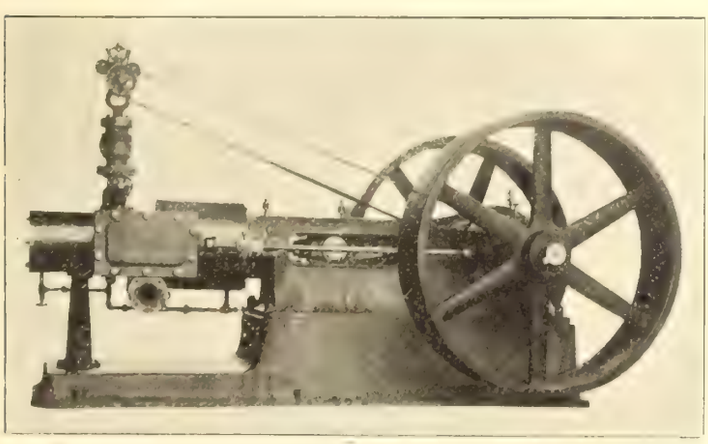
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Simplified Valves

Universal Application

Perfect Design

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THE HARDILL COMPOUND ENGINE CO.,
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PERSONAL.

Mr. J. W. Gledhill has been appointed electric light commissioner for the corporation of Huntsville, Ont.

Mr. P. Bowler has been reappointed city electrician of New Westminister, B.C., at a salary of $125 per month. Mr. W. A. Robinson has been engaged as chief engineer.

Mr. J. M. Buntzen, manager of the British Columbia Electric Railway Company, Vancouver, B.C., is now in the east completing arrangements for the proposed power plant at Coquitlam Lake.

Mr. F. C. Armstrong, a Canadian well-known in electrical circles, now in the employ of the engineering firm of Dick Kerr & Company, London, England, is at present in Egypt on a business trip.

Mr. T. Ahearn, president of the Ottawa Street Railway Company, and party, have returned to Ottawa after visiting Egypt, Rome, Austria and other European countries. Mr. Ahearn was absent about four months.

Before leaving Montreal Mr. W. H. Browne, who for upwards of six years was general manager of the Royal Electric Company, and who has assumed the management of the Stanley Electrical Instrument Company, of Great Barrington, Mass., was banqueted at the Windsor Hotel by a number of friends. Senator Beique, in proposing the health of the guest of the evening, said he had worked shoulder to shoulder with Mr. Browne in many important enterprises and could appreciate his ability, zeal and talent. He had never met a man better organized, bodily and morally, for the work entrusted to him while in Montreal.

Mr. Alex. Mackenzie has returned to Toronto after a three years' sojourn in Sao Paulo, Brazil, in connection with the installation of an electrical plant by the Sao Paulo Light & Power Company. Mr. Mackenzie speaks in enthusiastic terms of the prospects of this company. At the present time their are in operation 33 motor cars, the earnings of which average $44 per car per day, or 34 cents per car mile, the track mileage in operation being 35 miles. There have been secured up to date contracts for 15,000 incandescent lights, of which 11,000 are in service, while contracts have been secured for 500 arc lights, of which 372 are now doing service. Contracts for stationary motors, aggregating 1,300 horse-power, have been closed.

TRADE NOTES.

A neat leaflet just to hand tells of the superior qualities of the Packard transformer as manufactured by the Packard Electric Company, of St. Catharines, Ont.

The Canadian General Electric Company have recently been appointed selling agents in Canada for the Ohio Brass Company, of Mansfield, Ohio, which company make a specialty of genuine bell metal motor bearings.

The Heine Safety Boiler Company, of Toronto, have secured the contract for water tube boilers for the new steam plant of the Jacques Cartier Power Company at Quebec. The contract for steam engines has been given to the Robb Engineering Company, of Amherst, N.S.

The Shawinigan Water & Power Company, of Shawinigan Falls, Que., have just awarded to the Pittsburg Reduction Company, of that place, a contract for 260 miles of aluminum wire for the proposed transmission line from Shawinigan Falls to Montreal. The contract is said to be the largest of the kind ever given in this country. The Pittsburg Reduction Company will at once erect a wire mill.

The Robb Engineering Company have shipped two engines to the Marconi Wireless Telegraph Company, for the station they are building at Glace Bay, C. B. One engine of 100 horse power is for driving the electric generator that supplies the current for the signalling apparatus, and the other of 20 horse power is for lighting the station and the buildings adjoining.

Canadian Motors, Limited, 710-720 Yonge street, Toronto, report the following recent sales of electric automobiles: "Stanhope", to Mr. Earnest A. Bremner, of London, England; "Runabout", to Mr. R. Y. Ellis, Avenue Road, Toronto; "Stanhope", to Dr. A. A. Macdonald, Simcoe st., Toronto. Mr. W. G. Bronson, Ottawa, and Dr. Cotton, Simcoe street, Toronto; "Oxford", to Mr. C. T. Grantham, Hamilton, Ont.; "Stanhope" to Mr. G. E. Henderson, Rosedale, Toronto, and "Stanhope" and "Runabout" to Shippery Bros., London, Eng.



Pittsburgh
Transformers



CABLE JOINT—PREVENTS SYPHONING OF OIL.

Have you noticed the oil syphon from a transformer drop by drop?

Have you noticed that it does not do so in Pittsburgh Transformers?

A solid section in each cable prevents this. (It is patented.)

Pittsburgh Transformer Company
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BOILERS
Water Tube, Return Tubular, Lancashire, Marine, Locomotive and Vertical . . .

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Machinery, Heavy Forgings and Castings of Every Description .

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WATER WHEELS, ETC.

SPARKS.

The Beauharnois Light, Heat & Power Company has registered in Montreal.

W. A. McKay & Company, electrical supplies, North Sydney, N. S., have registered partnership.

A charter has been obtained by the Empire Electric & Manufacturing Company of Ottawa, Limited.

The Ontario Government has granted incorporation to the Penberthy Injector Company, of Windsor, Ont., which will have a share capital of $40,000.

The Owen Sound Electric & Illuminating Company, of which Mr. S. J. Parker is manager, have offered to dispose of their plant to the town for $47,000.

Incorporation has been granted to the National Electric Company, of Toronto, with a capital of $40,000. Messrs. J. E. Webb, G. M. Hendry and William Beall are directors.

The Oshawa Steam & Gas Fittings Company, of Oshawa, Ont., has been organized, with a capital of $50,000. The provisional directors are Messrs. W. F. Cowan, J. D. Storey and H. T. Carswell.

Mr. Campbell, engineer in charge of the Peterborough Street Railway, has been instructed to proceed with the purchase of the equipment required for the operation of the road. The overhead equipment will be purchased from the Canadian General Electric Company. The track and cars will be repaired and put in first-class condition.

The world-famed church at Ste. Anne de Beaupre, Que., is now lighted by electricity. In all some 1500 lights have been installed, the altar alone containing upwards of 600. The work of installation is estimated to have cost $20,000.

The Selkirk Electric Light Company, of Selkirk, Man., have appealed against the court decision giving $1,500 damages to Rev. Mr. Davidson for the death of his son, who was killed in the power house through coming in contract with a live wire.

The Granby Smelter Company, of Grand Forks, B. C., have awarded the Westinghouse Electric & Manufacturing Company the contract for supplying two electric motors each of 700 horse power capacity for driving the two 30-drill compressors to be installed in the mines in Phoenix. The Canadian General Electric Company has been given an order for a 100 horse power motor for operating the crusher, also for the transformers for the Cascade power plant.

Messrs. Strickland & Company, electrical contractors, Toronto, acting for the city of Guelph, have valued the gas and electric plants of the Guelph Light and Power Company, as it is proposed to place a proposition before the electors to take over and operate the plants under municipal control. The same firm have recently completed the valuation of the electric light plant in the town of Gravenhurst, Ont., but as the owner has decided not to accept the price offered by the town, the matter will be decided by arbitration.

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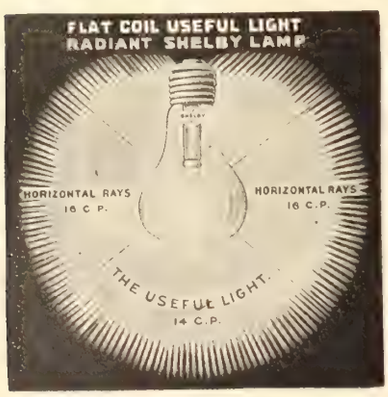
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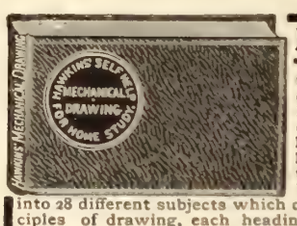
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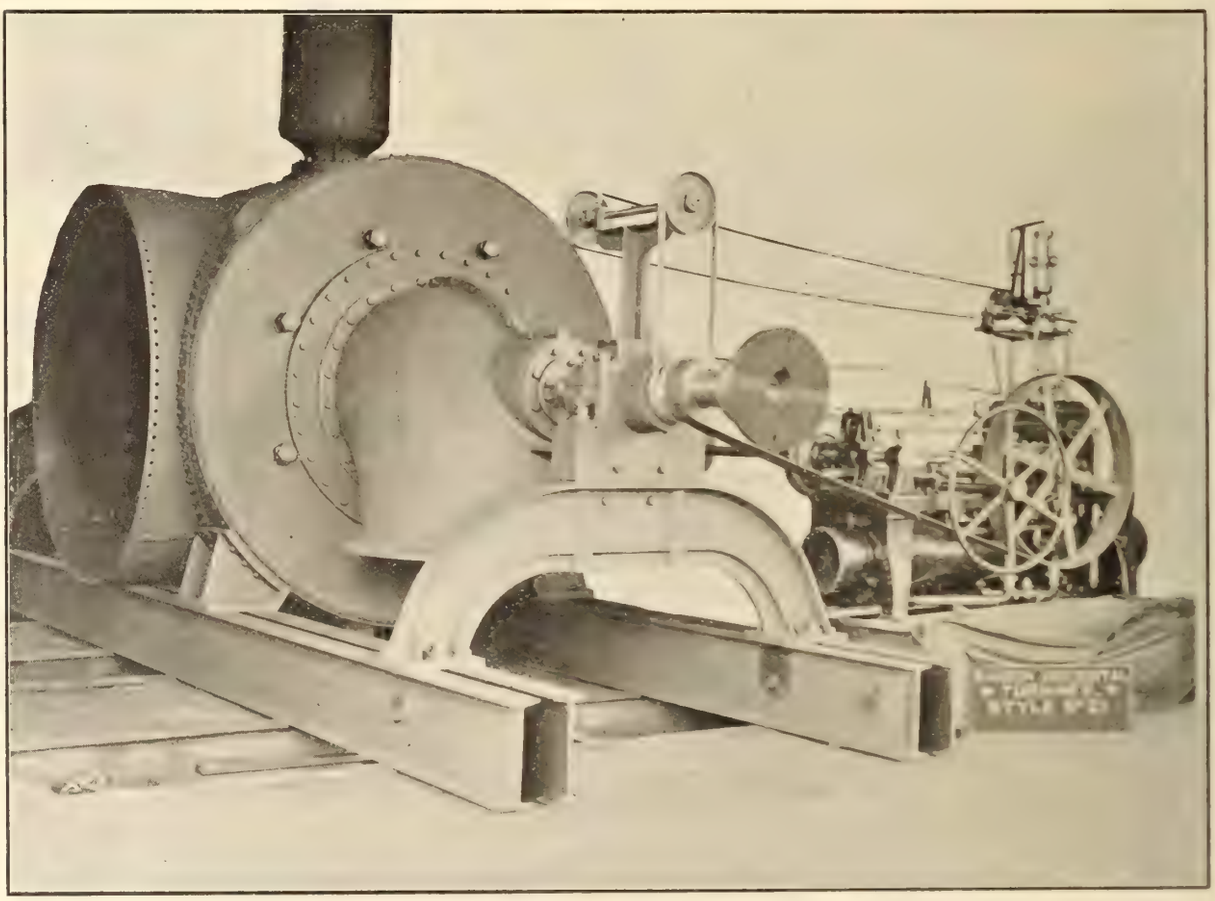
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SPARKS.

The Sarnia Gas & Electric Light Company are erecting a new building, from plans by Mr. Fawcett.

The International Transit Company have taken tenders for the construction of from four to five miles of electric railway at Sault Ste. Marie, Ont.

The Cumberland Electric Lighting Company, Limited, has been incorporated, with a capital of $25,000, to establish an electric light system at Cumberland, B.C.

At the annual meeting of the Shawinigan Water & Power Company, held in Montreal last month, the statement presented placed the value of the power development at $1,350,000, real estate and building $960,000, and electric railway $70,000.

A Canadian company has been formed for the manufacture of the Chapman double ball bearing, which is on exhibition at the company's office, 39 Scott street, Toronto. A line of shafting has been put up equipped with this bearing, which demonstrates very clearly its anti-friction qualities.

It is reported that the largest electrical plant in the United States, capable of generating 300,000 horse power, is about to be installed on the north fork of the Feather River, in California. It is thought that in addition to being used for developing the mining and lumbering interests in the vicinity, the power may be carried to San Francisco, a distance of 175 miles.

Incorporation has been granted to the Mackenzie Power & Development Company, Limited, of Parry Sound, Ont., with a share capital of $50,000.

The general meeting of the British Columbia Electric Railway Company was held in London, England, on May 24th, when $1,350,000 was set apart for improvements to the company's plant. About $750,000 of this sum will be expended in establishing a water power plant at Coquitlam Lake. The car works to be established will cost about $40,000. These will be located at New Westminster, where all repairing will be done which cannot be executed at the Vancouver or Victoria shops. Improvements will be introduced by which, in case of a break-down of street car or line, telephone communication can be had at any point with the company's office or with the power house. Each car will be provided with an apparatus which, in a moment, can be applied to the wire and the office notified. It is the intention of the company to renew the offer made last year to furnish street and commercial lighting in New Westminster, B.C.

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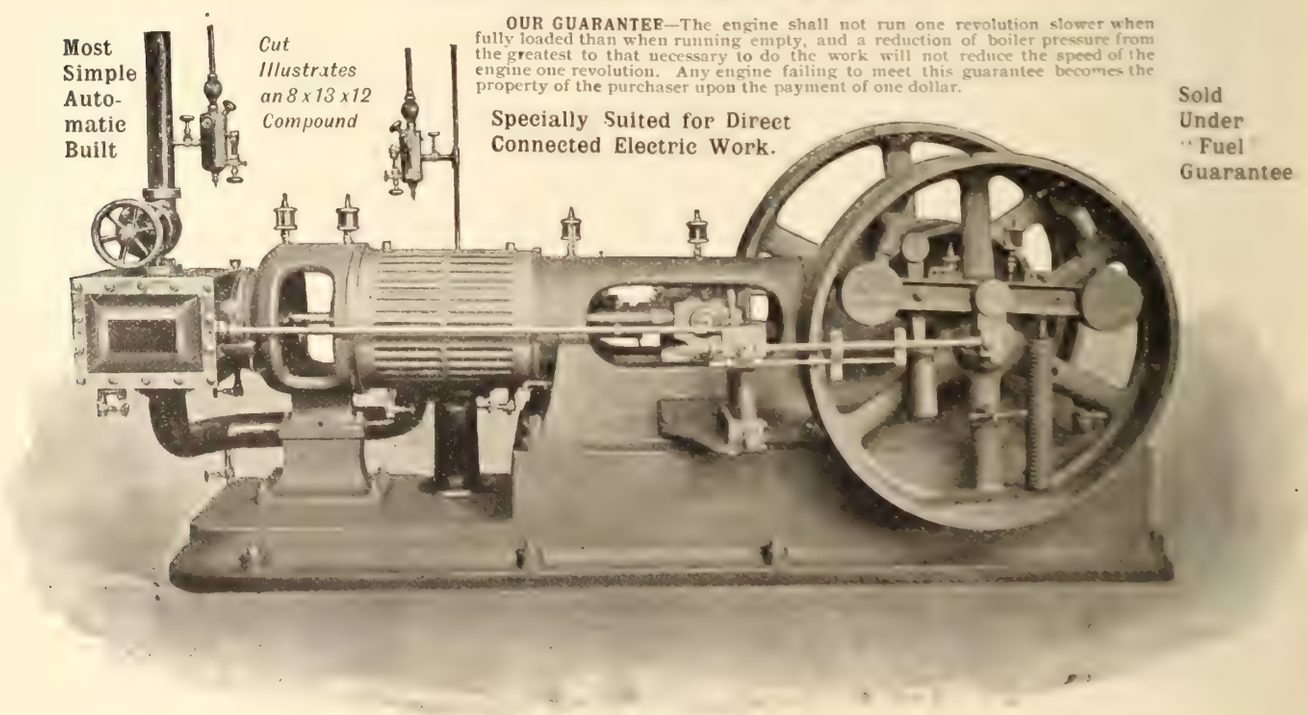
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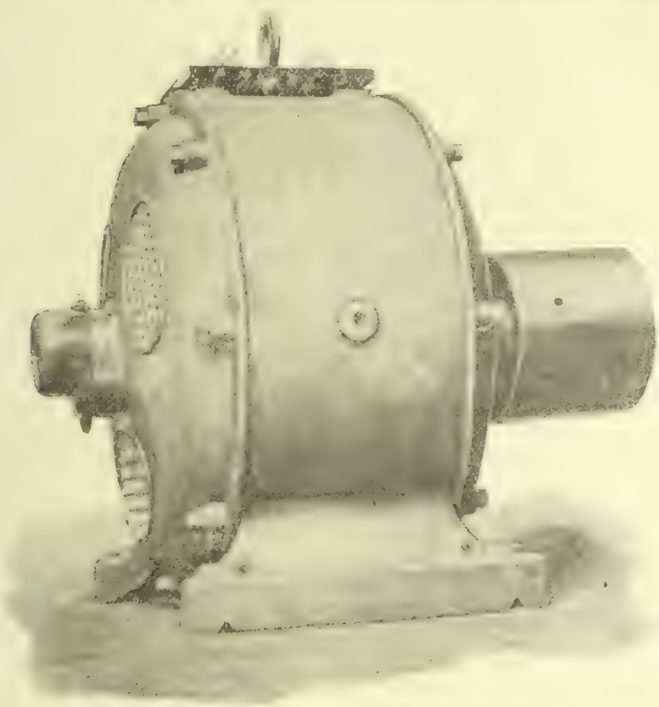
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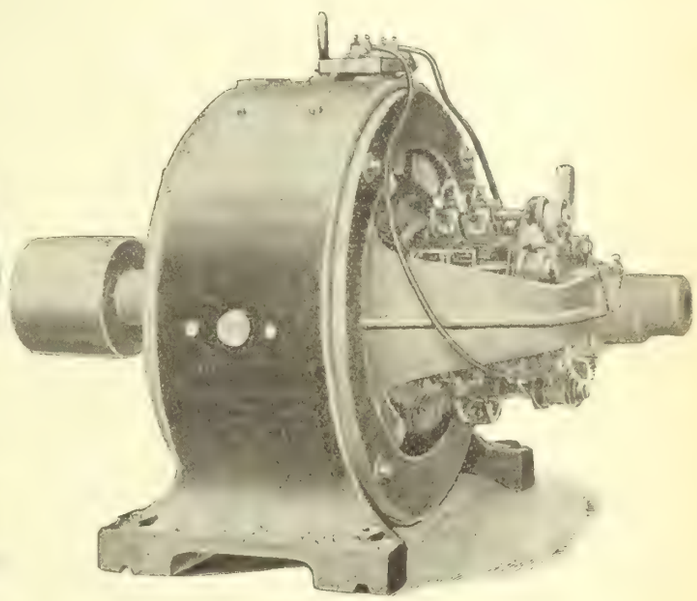
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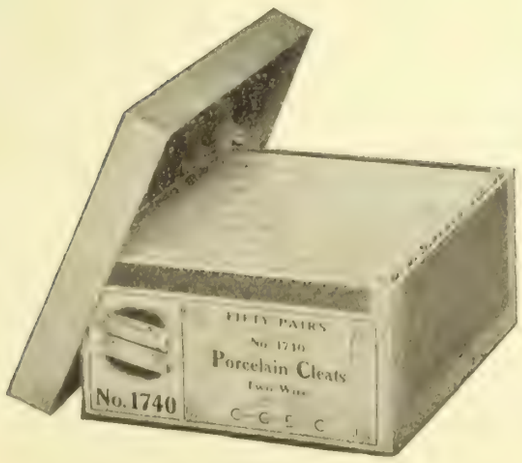


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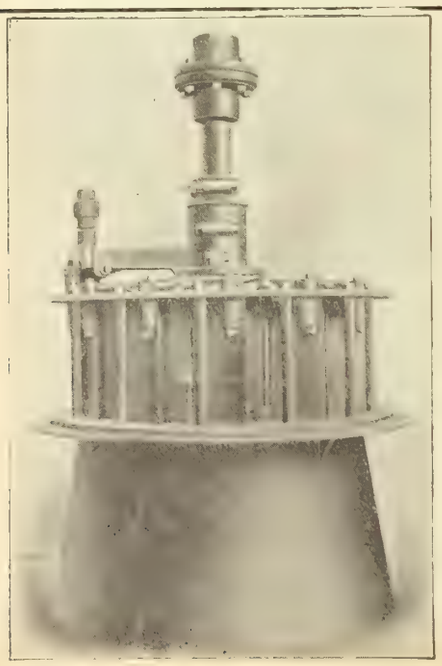
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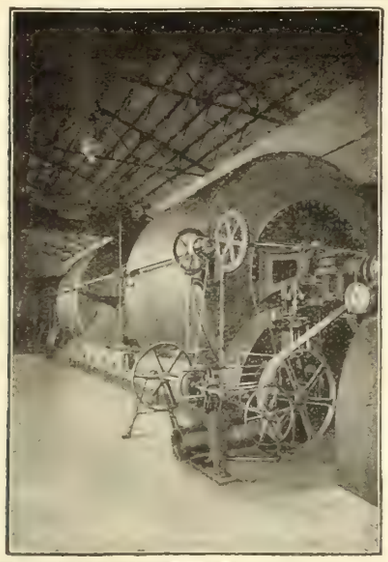
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WRITE FOR CATALOG. DEPARTMENT E.

MESSRS. DICK KERR & CO. ESTABLISH A CANADIAN AGENCY.

Mr. J. M. Campbell of Kingston, Ont., who is well known to the electrical fraternity in Canada as formerly a representative of the Canadian General Electric Co., has recently returned from a trip to England and the Continent. While abroad he made arrangements with Messrs. Dick Kerr & Co., Limited, of London, Eng., by which he will have charge of their Canadian business. Mr. Campbell has associated with him in this undertaking Mr. T. T. Renton, a well known business man of Kingston.

Dick Kerr & Co. have large works at Preston, Lancanshire, devoted exclusively to the manufacture of electrical apparatus, as well as Kilmarnock, Manchester and Glasgow. The electrical works at Preston are modern in every respect, and with expert designers, and progressive business managers, the machinery turned out is the very best that can be produced. The designing of the electrical apparatus is under the supervision of Prof. Short, formerly of Cleveland, Ohio, and well known as one of the foremost American designers. Prof. Short has associated with him several experts in alternating current work, who have had experience in both European and American practice.

The head office of the Company in London is under the management of Mr. W. R. Rutherford, with Mr. F. C. Armstrong as manager of the electrical department. These gentlemen are well known in Canada, being formerly connected with the Canadian General Electric Co. Mr. E. A. Stanley a former official of the same Company, has charge of the large tram-car department of the Dick Kerr Co.

At the present time this progressive English Company have contracts under way in India, South Africa, Australia, Straights Settlements, Egypt, in fact all over the world. They have over 5,000 men on their pay roll.

They announce their intention to get their share of the Canadian business, and the Canadian staff is now being organized to work the country thoroughly, from the Atlantic to the Pacific.

FEES FOR ELECTRICAL INSPECTION.

The Dominion government has just passed an order-in-council for the purpose of grading the registration fees paid by electric light companies from $25 down to $5, according to the business done by the company.

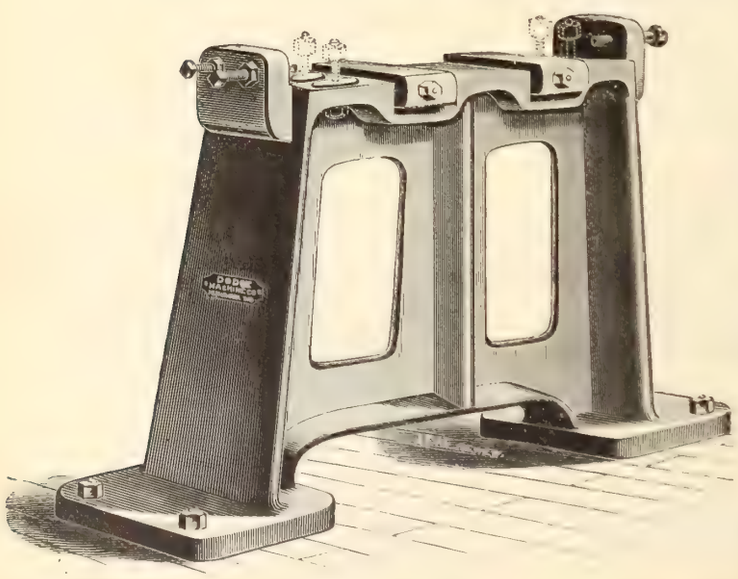
Some years ago the government passed an electric light inspection act, which provided for the verification by the government of all meters used. In order to keep track of companies in Canada it was provided that all should obtain a license every year, for which they were to pay $25. This was considered too small for large concerns and a considerable tax upon smaller ones. It is not generally known that the Act contains a provision for electric light consumers who are doubtful regarding the accuracy of meters to have them tested by the government. If such test proves that the meter is correct within 3 per cent., the consumer pays inspection fee, which is $2. If otherwise, the company settles.

The new schedule is as follows : For all companies having an installation of 500 incandescent lamps and under $5 a year ; all companies having an installation of over 500 and not exceeding 2,000 incandescent lamps, $10 a year ; and all companies having an installation in excess of 2,000 incandescent lamps, a fee of $25 a year. Each arc lamp is to be deemed equal to ten incandescent lamps. Each company registering shall be entitled to a test of voltage and a comparison of their measuring instruments with the departmental standard once in each year free of charge.

The new regulation comes into force on July 1st next.

JACK SHAFT EQUIPMENT

For Electric Light and Power Plants.



Floor Stands,
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Friction Clutch Pulleys,
Clutch Couplings,
Iron Pulleys,
Iron Centre Wood Rim Pulleys
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MADE IN CANADA.

It seems impossible to conceive any good feature of meter practice that is not incorporated in the new Type "G" Scheeffer Recording Watt Meter.

This meter is an induction meter and commutator and brushes with their constant varying friction are done away with.

It begins registering at about ½ of 1% of its full load and will record accurately a heavy overload.

This meter is correct on pressure balance and there is absolutely no movement except when current is being used.

Full particulars concerning this meter will be sent upon request.

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TRADE NOTES.

An attractive paper weight is being sent out by the Chicago Fuse Wire & Manufacturing Company to the electrical companies.

Mr. James Bennett, formerly of the Royal Electric Company, but who for the past five years has occupied the position of superintendent of the Montreal Electric Company, and Mr. Rene Moncel, also connected with same firm, have formed a partnership in Montreal as electrical contractors under the firm name of Bennet & Moncel. They are located in the Witness Block, 140 St. Peter street.

Mr. E. S. Cooper, of Galt, Ont., has gone to Winnipeg to join Mr. Jas. Burridge in the late firm of The Burridge Company, agents for The Goldie & McCulloch Company, Gall, Ont. Mr. Cooper has long been associated with The Goldie & McCulloch Company as salesman and manager of their Gasoline Engine Department, and is also thoroughly experienced in the other lines of their business. He will take the active management of the outside work of the new firm, Burridge & Cooper, and within in a few weeks it is expected they will open out and carry a large stock of the products of The Goldie & McCulloch Company. Mr. Burridge has been identified with the business community of Winnipeg and vicinity for over twenty-three years.

Westinghouse, Church, Kerr & Company announce the removal of their Pittsburg office from its former location on the first floor of the Westinghouse Building to more commodious quarters on the eighth floor of the same building. This change is the direct outcome of largely increased business in this district, and is accompanied by the acquirement of a commodious reception room devoted exclusively to the convenience and entertainment of visitors and patrons. The object of the management in making the change is to be able to accommodate more thoroughly and promptly the wishes and needs of their patrons. They are prepared to give immediate attention to all classes of general engineering and construction work as applied to power and its uses in transportation and industry. They will provide in all cases from their engineering force adequate personal supervision of work in hand, both during construction and subsequent thereto, and the increased facilities afforded by their new quarters will enable them to fulfil the most extensive contracts. The official address is: Westinghouse, Church, Kerr & Co., Westinghouse Building, Pittsburg, Pa.

The Trenton Electric Company, of Trenton, Ont., intend developing additional water power and building a second transmission line to Belleville.

Mr. L. B. McFarlane, general superintendent of the Bell Telephone Company, Montreal, was in Toronto recently. He stated that the company was at present making great changes in connection with its long distance service. In Manitoba the company was erecting a line from Winnipeg south to the American boundary to connect with companies in the United States having connection with North and South Dakota, Minnesota and Wisconsin.

MOONLIGHT SCHEDULE FOR AUGUST.

Day of Month.	Light.		Extinguish.		No. of Hours.
		H.M.		H.M.	H.M.
1....	P.M.	7.50	P.M.	4.00	8.10
2....	"	7.50	"	4.00	8.10
3....	"	7.50	"	4.00	8.10
4....	"	7.50	"	4.00	8.10
5....	"	7.50	"	4.10	8.20
6....	"	7.50	"	4.10	8.20
7....	"	7.50	"	4.10	8.20
8....	"	7.50	"	4.10	8.20
9....	"	8.45	"	4.10	7.25
10....	"	9.30	"	4.10	6.40
11....	"	10.00	"	4.20	6.20
12....	"	10.45	"	4.20	5.35
13....	"	11.30	"	4.20	4.50
15....	"	0.20	"	4.20	4.00
16....	"	1.15	"	4.20	3.05
17....	"	2.10	"	4.20	2.10
18....	No Light.		No Light.		
19....	"		"		
20....	"		"		
21....	A.M.	7.30	A.M.	9.30	2.00
22....	"	7.30	"	10.00	2.30
23....	"	7.20	"	10.30	3.10
24....	"	7.20	"	11.15	3.55
25....	"	7.20	"	0.00	4.40
26....	"	7.10	"	0.50	5.40
27....	"	7.10	"	1.50	6.40
28....	"	7.10	"	2.50	7.40
29....	"	7.10	"	4.00	8.50
30....	"	7.10	"	4.30	9.20
31....	"	7.00	"	4.30	9.30
			Total		170.00



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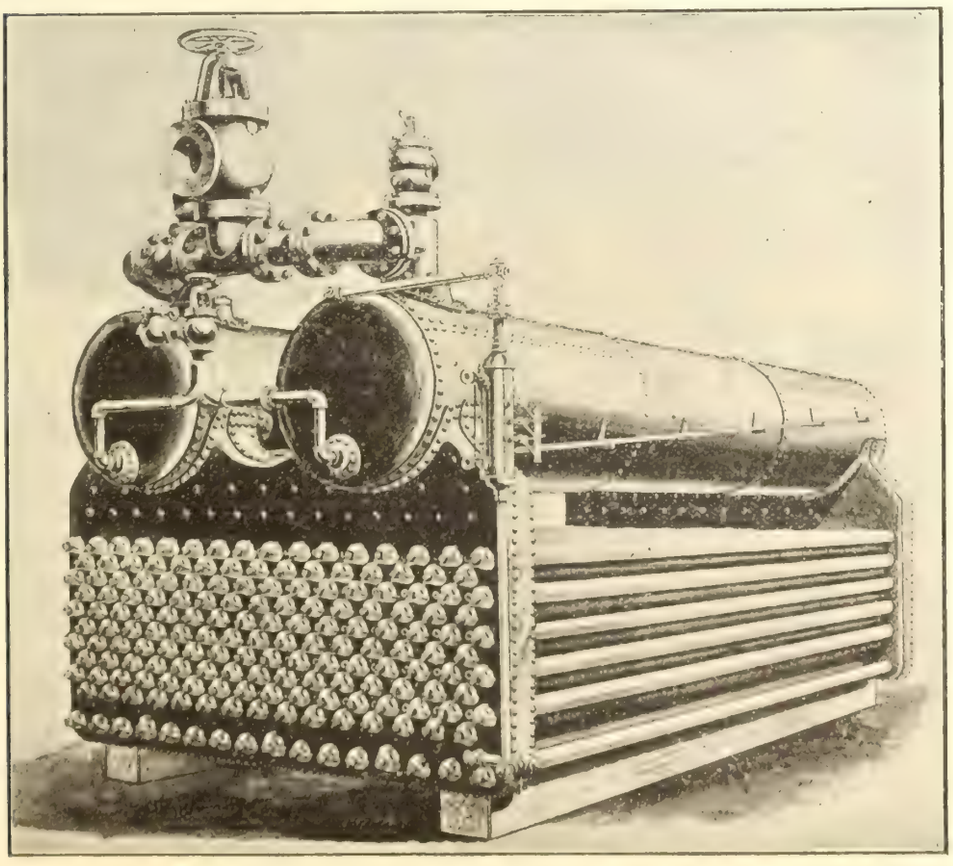
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Lundell Fan Motors

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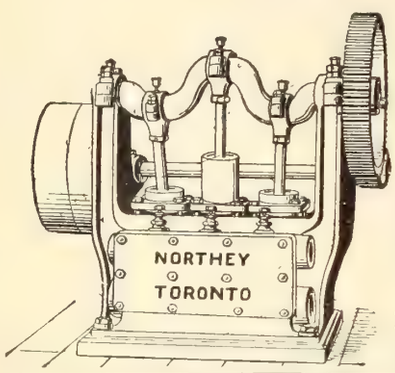
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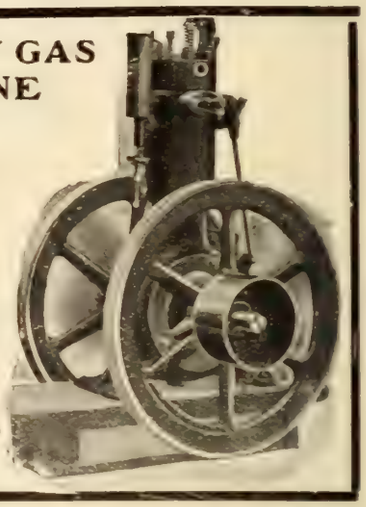


This pump excels in high class materials and workmanship. A practically constant delivery is assured by the three cranks being placed 120 degrees apart. The pump can be operated conveniently by water power—by belt from engine or by electricity.

We manufacture pumps of every description—for all purposes. Our pumps are standard in Canada for excellent service.

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The Northey Gasoline Engine offers the best proposition in the market for cheap, easily handled power. The Engine runs with practically no attention—any boy can manage it—running expenses very light. Ready for work on the minute. Suitable for running independent electric light plants—pumping and elevator plants, etc. This cut illustrates the ½ .P . size—the only vertical style built, all other sizes are horizontal.

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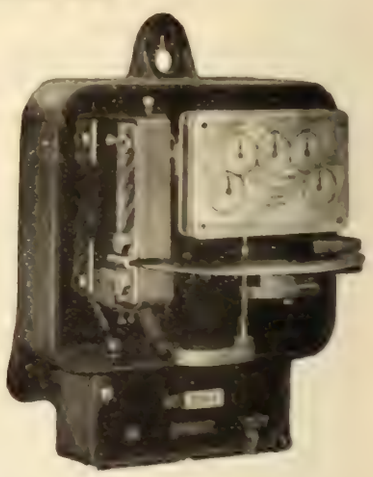
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FOR ALTERNATING CURRENTS



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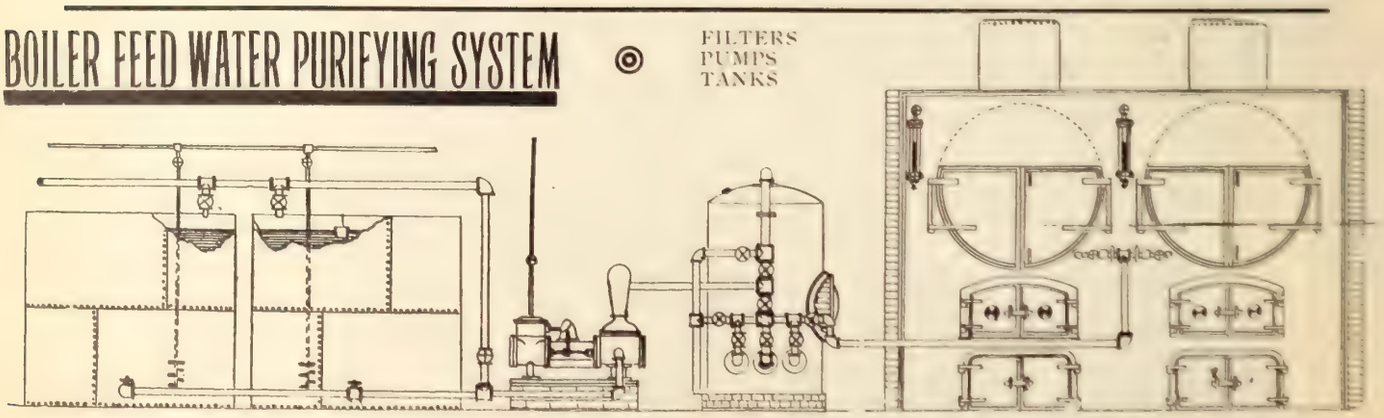
The New Meter is of the sealed type.
Is correct on all loads from two per cent. of its capacity to fifty per cent. overload.
Internal losses are practically nothing.
Accuracy maintained.
Simplicity in design.
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Dust, insect, moisture and water proof.
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PUMPS
TANKS



JOHN McDOUGALL - Caledonian Iron Works MONTREAL, QUE.

CANADIAN
ELECTRICAL NEWS
AND
ENGINEERING JOURNAL

VOL. XII. JULY, 1902 No. 7.

THE OTTAWA ELECTRIC COMPANY.

We have received a copy of the eighth annual report of the directors of the Ottawa Electric Company, which was submitted at the annual meeting held on June 30th. The report says: "The completion of the new power house with its more modern system of generating and distributing electrical energy has enabled the management to effect the contemplated economies with most pleasing results, as a reference to the accompanying statements will show, notwithstanding that it was only possible to put the majority of such economies into full effect during the latter half of the year, dating from the opening of the new power house on the 16th November last.

"The Company's operations for the past year show a gross revenue from all sources of $227,634.83, being an increase of $31,271.61 over the previous year after making liberal provision for bad and doubtful debts.

"The gross cost of operating and maintenance was $115,244.02, leaving a profit of $112,390.81, from which profit is deducted $25,913.38 for interest paid upon bonds and current liabilities, leaving the net profit $86,477.43.

"The precentage of maintenance and operation to gross receipts was practically 50 per cent. Your Directors deem it important to mention that a considerable amount of work done during the past year in the nature of permanent improvements which was charged to Operation and Maintenance, might properly have been considered as capital expenditure. An amount of $75,000 has been carried to Depreciation Account, to provide for wear and tear and general depreciation of plant. Your attention is respectfully called to the continued increase of installations, and in the number of customers.

The following statistical statement shows the growth of the Company during the past three years:

Total Number of	30 April 1900	30 April 1901	30 April 1902
Lights "Incandescent"	87,114	93,207	104,407
Lights "Arc"	644	650	752
Heaters	23	17	24
Motors	103	133	157
Customers	4,357	5,208	5,820

The directors, at a subsequent meeting, elected the following officers: T. Ahearn, president; F.P. Bronson, vice-president; D. R. Street, secretary-treasurer; A.A. Dion, general superintendent; A. Bayly and R. Quain, auditors.



MR. K. B. THORNTON, 2nd Vice-President.



MR. B. F. REESOR, President.



MR. EDWARD SLADE, 1st Vice-President.

OFFICERS OF THE CANADIAN ELECTRICAL ASSOCIATION FOR 1902-3..

Never advertise without a definite purpose in view —let that purpose be the intreasing of trade in some particular branch of your business.—The Adviser.

CANADIAN ELECTRICAL NEWS AND ENGINEERING JOURNAL

PUBLISHED ON THE TENTH OF EVERY MONTH BY

THE C. H. MORTIMER PUBLISHING CO'Y of Toronto, Limited,

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Advertising rates sent promptly on application. Orders for advertising should reach the office of publication not later than the 28th day of the month immediately preceding date of issue. Changes in advertisements will be made whenever desired, without cost to the advertiser, but to insure proper compliance with the instructions of the advertiser, requests for change should reach the office as early as the 26th day of the month.

SUBSCRIPTIONS.

The ELECTRICAL NEWS will be mailed to subscribers in Canada, or the United States, post free, for $1.00 per annum, 50 cents for six months. The price of subscription should be remitted by currency, registered letter, or postal order payable to the C. H. Mortimer Publishing Company of Toronto, Limited. Please do not send cheques on local banks unless 25 cents is added for cost of discount. Money sent in unregistered letters will be at senders' risk. Subscriptions from foreign countries embraced in the General Postal Union $1.50 per annum. Subscriptions are payable in advance. The paper will be discontinued at expiration of term paid for if so stipulated by the subscriber, but where no such understanding exists, will be continued until instructions to discontinue are received and all arrearages paid.

Subscribers may have the mailing address changed as often as desired. When ordering change, always give the old as well as the new address.

Subscribers are requested to promptly notify the publishers of failure or delay in the delivery of the paper.

EDITOR'S ANNOUNCEMENTS.

Correspondence is invited upon all topics coming legitimately within the scope of this journal.

The "Canadian Electrical News" has been appointed the official paper of the Canadian Electrical Association.

CANADIAN ELECTRICAL ASSOCIATION.

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B. F. REESOR, Manager Electric Light & Power Co., Lindsay, Ont.
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EDWARD SLADE, General Superintendent Jacques Cartier Light & Power Co., Quebec.
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P. G. GOSSLER, General Superintendent and Electrical Engineer, Montreal Light, Heat and Power Co., Montreal.
ORMOND HIGMAN, Chief of Electrical Inspection Department, Ottawa.
ED. A. EVANS, Manager Quebec Railway, Light & Power Co., Quebec, Que.
A. A. DION, Superintendent, Ottawa Electric Co., Ottawa, Ont.
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Information regarding examinations will be furnished on application to any member of the Board.

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Conductor, JOHN M. DIXON	Toronto, Ont.
Door Keeper, J. STRUSTHER	Sarnia Ont.

South African Trade.

WITH the ending of the war in South Africa will come a period of great development in that country and a consequent demand for many lines of manufactured goods. German and Austrian syndicates are said to be forming to exploit the South African market. With cool audacity the continental countries which as far as possible supported the Boer cause and obstructed the British are now seeking to reap the commercial advantages arising out of the conditions established by Great Britain at an enormous cost in men and money. The United States have been exporting largely to South Africa and their trade returns for the first half of this year show a substantial increase above the same period of 1901. It seems only fair to her own interests that Great Britain should impose some restrictions in the form of duties on foreign goods entering the South African market, thereby giving a preference to home and colonial industries, which will have to bear a considerable proportion of the expenses of the war, and compelling foreign countries to pay something for the commercial advantages which are the direct result of the long continued and successful struggle conducted by Great Britain. Canadian exporters of manufactured goods should lose no time in establishing trade connections in South Africa, and should be properly represented at the South Africa, British and Colonial Industrial Exhibition to be held in Cape Town, from Nov. to Feb. 1903-4.

The Canadian Electrical Association

WE have the pleasure to record another successful meeting of the Association and a further step forward in the direction of increase of membership and influence. The convention held in Quebec last month in some respects proved a surprise of a very agreeable character. In view of the distance to be travelled it was not expected that the attendance would reach the usual standard. On the contrary it exceeded all previous records by at least 25 per cent. The papers were of a very high standard, and treated of interesting phases of electric light and power and street railway engineering. Several of them were illustrated by means of specially designed apparatus the transportation and fitting up of which involved a great deal of labor and not a little expense. Several of these papers are printed in the present number and though lacking their full interest by reason of the absence of the explanatory apparatus, will amply repay careful reading. Much value attaches also to the discussions arising out of papers, reports of Committees and resolutions. There ought to be a large representation at future Conventions of the electric light and power companies to whom the Association has been of most benefit. It will pay every such company doing a business of moderate proportions to have a representative present at these yearly gatherings. By so doing they will be able to compare notes with and derive large benefit from the experience of men in their own line of business. Several private companies as well as corporations operating Municipal plants have already seen the wisdom of adopting this course, and no doubt the number will increase year by year. The well-known hospitality of the citizens of Quebec was manifested in the courtesies extended on every hand to the visitors and particularly in the trips and social events so carefully planned by the Local Committee in association with the citizens. With the excellent list of officers elected to manage the affairs of the Association, the present year is certain to be marked by progress, and should terminate with another successful convention in Toronto next June.

Canadian Electrical Association

Proceedings of the Twelfth Annual Convention

THE twelfth annual Convention of the Candian Electrical Asssociation was held in the Assembly Hall of the Chateau Frontenac, in the City of Quebec, Que., on Wednesday, Thursday and Friday, June 11th, 12th and 13th, 1902.

The opening session was held on Wednesday at 10.15 o'clock a.m., when the President, Mr. P. G. Gossler, of Montreal, occupied the chair and called the Convention to order.

The following persons were registered as being in attendance :

Fred. Thomson, G. R. Duncan, D. Sleeth, J. P. Thomson, F. W. Fairman, F. H. Leonard, Geo. C. Rough, K. B. Thornton, P. G. Gossler, A. Esling, Cecil Doutre, A. P. Horner, F. John Bell, D. W. McLaren, C. W. Henderson, Geo. W. Sadler, Alfred Collyer, G. M. Wight, A. S. Forman, W. V. Warren, J. A. Burns, W. F. Dean, Geo. H. Olney, H. W. Weller, L. J. Belnop, A. Milton Smith, W. L. Macfarlane, R. A. Stinson, T. W. Casey, J. H. Lachapelle, Montreal, Que. ; P. J. Begin, D. E. Blair, Edward A. Evans, L. Dennis, W. H. Wiggs, Guy H. Simpson, G. Hartman, Edwin Pope, Edward Slade, Lewis Burran, Arthur P. Doddridge, George Reed, P. H. Gale, G. U. G. Holman, Charles W. Ross, William Langford, H. A. Dauphin, Thomas W. Kell, G. A. Montgomery, John James, Frank Carroll, Quebec, Que.; A. A. Dion, W. G. Bradley, Thomas Hilliard, M. Mavaut, A. A. Couvrette, Ormond Higman, T. Ahearn, Warren Y. Soper, James D. Fraser, C. W. Henderson, Ottawa, Ont.; J. J. Wright, Acton Burrows, H. G. Nicholls, W. Nicholls, Geo. W. Watts, J. W. Campbell, H. A. Moore, E. D. McCormack, Frank C. Smallpiece, W. McLeish, C. H. Mortimer, R. A. Stinson, Geo. Angus, A. B. Lamb, jr., Archibald B. Smith, T. F. Dryden, E. B. Biggar, E. Irving, Toronto, Ont.; R. T. Lozier, Russell Spaulding, J. C. Schaeffer, H. W. Bliven, P. H. Hover, Charles J. Marsh, Wm. B. Wreaks, New York ; W. D'A. Ryan, C. M. Green, Lynn, Mass.; L. G. Bassett, A. L. Tucker, W. B. Hale, Chicago, Ill.; Edward L. Reynolds, C. M. Wilkins, Philadelphia, Pa.; Frank G. Bolles, Cincinnati, Ohio; F. Schweetman, St. Louis, Mo., G. H. Berg, Boston, Mass.; Percy H. Thomas, Pittsburg, Penn.; A. A. Wright, Renfrew, Ont.; J. E. Skidmore, Cobourg, Ont.; B. F. Reesor, Lindsay, Ont.; D. W. Tully, Chateauguay Basin, Que.; F. W. Martin, St. Catharines, Ont.; S. E. Fletcher, Irving Smith, St. Johns, Que.; A. Sangster, R. N. Robins, Sherbrooke, Que.; John Yule, Guelph, Ont.; H. O. Fisk, Peterborough, Ont.; L. A. Cosgrave, Chicoutimi, Que.; J. W. Purcell, Walkerville, Ont.; A. C. Read, Levis, Que.; J. Camille Pouliot, Fraserville, Que.; V. B. Coleman, Port Hope, Ont.

The President: I now declare the Convention open for business. We have with us Alderman Tanguay, who has kindly consented to make a few opening remarks to the Convention. I have the honor of introducing Alderman Tanguay to the Convention. (Applause.)

Ald. Tanguay: Mr. President and Gentlemen: His Worship the Mayor being prevented from meeting you this morning on account of a previous engagement, I have the honor as pro Mayor of the City of Quebec to welcome you to this city. The Mayor asked me to express his regret at not being able to be here this morning. He would like very much to meet the gentlemen who compose so important an organization. I welcome you to our city with great pleasure and I hope you will enjoy your short visit amongst us; I trust you will be interested in following the programme that has been so well prepared, and I believe you will enjoy our hospitality which we give you with great heart. I thought of asking Captain Penny, our Chief of Police, to come and meet you this morning to offer you his services. (Laughter.) I must tell you that Captain Penny, in his capacity of Chief of Police, can be of great service to you, but can be otherwise too. He knows the city; he is what you might call a child of Quebec, he knows every corner and interesting spot, and besides I must tell you that you will find him very obliging. Gentlemen, once more I trust you will enjoy your short stay amongst us, and I hope I may have another opportunity of meeting you. I wish you all the best time possible. I thank you for your attention.

The President: I will call upon Mr. Dion to reply to Alderman Tanguay's kind welcome.

Mr. Dion: Alderman Tanguay, on behalf of the Canadian Electrical Association I thank you, and, through you, the Council and citizens of the City of Quebec for the very generous welcome you have just extended to us. We count it an honor and a privilege to meet you, Sir, and we esteem it a very great pleasure to assemble in your beautiful and very interesting city. Among the many attractions which draw towards this place, not the least are the magnificent electric installations which have been placed here within the last few years and which place your city in the very front rank amongst Canadian cities. The hospitality of your people, Sir, is proverbial, and we have no doubt that after our stay here a few days with you, we shall leave your city with regret, and shall carry with us the most pleasant memories of this Convention. I should also express my thanks for your consideration in having arranged to have the police tied up while we stay in the city. (Laughter and applause.)

The President: Following out a matter of custom and not complying with the Constitution I have prepared a few remarks addressed to the gentlemen and members of the Canadian Electrical Association:

PRESIDENT'S ADDRESS.

Gentlemen and Members of the Canadian Electrical Association:

It gives me much pleasure to meet you all on this occasion of the twelfth Annual Convention of our Association. It is particularly appropriate that we should meet here in this historic City of Quebec, which is so intimately associated with not only the early history of the settlement of this continent, but also with the very early history of the development of electric power transmission in Canada.

That part of the business of this country with which so many of the members have been and are now intimately and prominently associated, namely, the development and operation of water power plants for electric transmission, was greatly encouraged in its early stages by the successful utilization of Montmorency Falls for lighting and power purposes.

We have on all sides of us in this city abundant proof of the continuance of the courage, foresight and energy which must necessarily have been characteristic of those who promoted and brought to a successful completion such an undertaking as the transmission of electric power from Montmorency Falls, at a time when high tension apparatus and lines used for the supply of commercial light and power were looked upon by the general public with some doubt, and considered, by many, as being an experiment.

It is only necessary for us to inspect the power houses, substations and electric railways in and around Quebec to make us realize what tremendous strides have been made throughout the country and here in this very city in the utilization of electricity since the installation of the Montmorency plant which, I think I am safe in saying, was the first high tension system put into commercial use in this country.

It is, therefore, apparent why Quebec is an ideal city for a Convention of an electrical association, for no place else could this extraordinary progress be more emphatically contrasted. We have here an excellent opportunity of seeing modern power plants, supplying current for all branches of industry, and of acquainting ourselves with the successful solution of some of the problems of long distance, high tension power transmission.

It is to be regretted that the programme for this meeting could not include a visit to all of the power houses in the city or immediate vicinity, but those who have the time will be amply repaid by visiting them. The local committee have provided so generously for our entertainment that it has been impossible to include on our programme all of the many attractive features offered.

The Association is to be congratulated on the sound and healthy condition in which this Convention finds it. The Report of the Secretary-Treasurer shows that we have a surplus in the Treasury sufficiently large to meet all of our ordinary requirements and to enable us to carry out any work which we may think wise to inaugurate; and the steady increase in membership gives strong evidence of the life and vitality of the Association itself.

One of the objects of the organization, as set forth by the Constitution, is to promote the interests of those engaged in any electrical enterprise; to successfully secure this object, its influence must be far-reaching, and all companies, firms and persons interested in the electrical industries should be related to each other through the medium of the Association.

The steady increase in membership in the last few years, and the very marked widening of interest in the proceedings, justifies us in expecting that within a comparatively short time, every company or person interested in the electrical industries in Canada will be represented on our membership roll.

At the last Convention there was an amendment made to the Constitution, whereby membership was divided into several classes. While this amendment provides that manufacturers are not eligible to active membership, I want to emphasize that this Association wants and requires the cooperation and assistance of the manufacturers.

A report of a largely attended meeting of the Executive Committee, held in January last, has been placed in your hands, and from it you will have noted the generous gift to the Association by one of our manufacturing members, which is a very substantial and material reminder of what help manufacturers are to the Association.

The Executive Committee decided to set this donation aside as a special fund, out of which is to be allotted a yearly sum to be awarded in prizes for papers presented before our Annual Convention. It is expected by this means to encourage members to devote more time to original work or to preparing for publication an account of any unusual or extraordinary results arrived at or work carried out by them or under their supervision.

The Committee having in hand the formation of a set of rules governing the awarding of this prize have not been able to put them in shape for the Convention, but it is expected that they will be completed and presented to the members before the close of the present session.

You will receive and have read the reports of the several Committees and you will have presented and discussed several excellent papers dealing with subjects of great interest and importance to this Association.

While the report of the Legislative Committee will state that no legislation was enacted during the past year that has counteracted the good results or broken down the proper and just safeguards placed around our business, and which owe their existence to the direct and strenuous efforts of this Association and its Committee; yet we must not lose sight of the fact that there is an under-current tending towards legislation which would deprive many existing Companies and much invested capital of their legitimate rights and protection.

I attribute this tendency on the part of some of the advocates of such measures to their ignorance of the business ; and their ignorance has not been very much enlightened by the opinions given to the public by some men identified, in more or less responsible capacities, with the electrical industries of this country. I deem it my duty to bring it to your attention that certain evidence has been given during the past year in arbitrations required by the Conmee Act, which cannot do otherwise than have the tendency to depreciate the value of plants below the point which, I am of the opinion, would be approved of by this Association. I have reference to such statements as tend to confuse the mind of the public, and give the impression that the value of a plant is that for which it could be replaced at the present day by new equipment, no consideration or value being placed upon the fact that these pioneer organizations, by establishing that electrical companies were a commercial possibility and a means of making a fair return on the capital invested, have made it possible for construction and manufacturing companies to now install and supply equipment at figures much less than the prices of ten years ago.

It is, therefore, the duty of this Association, in carrying out its obligations, to promote the interests of its members, that it discountenance and discredit such publicly expressed opinions, which may have a tendency to put other than fair value on the properties of electrical companies.

I would call your special attention to the Report of the Committee to Confer with the Board of Fire Underwriters from which it will be noted that there is an effort on the part of one of the largest cities in this this country, by the Board of Fire Underwriters to force upon the city the expense and responsibility of establishing a system of inspection for electrical installations. The Fire Underwriters of the United States, and, to a limited extent, in this country, have found it to their advantage to establish bureaus of inspection of their own and to control and operate them at their expense.

That an efficient and thorough periodic inspection of all electrical installations is necessary and desirable, we will all agree, but the cost of this inspection must not be made a hardship to the customers of electrical companies : otherwise the rapid development and universal use of electricity for all purposes—commercial and domestic—will be hampered.

I am strongly of the opinion that the interests of all parties will be best served by having electrical inspection bureaus established and operated at the expense of the Fire Underwriters ; they have thought it advisable, for their own interests, to form a set of rules to govern the installation of electrical apparatus—why should they not see that these rules are enforced, especially as they have a most efficient means within their control of enforcing these rules, namely cancelling the policies on such properties when the electrical installations are not in accordance with the established practice or the Underwriters' rules.

We are in the midst of an era of great prosperity ; the expansion of the business of electrical companies during the past few years has never been equalled in the same time in any other industry, with the result that many of the companies have had more business at fair and profitable rates than they could conveniently handle. On the other hand, some of the companies, in their efforts to get business, regardless of the price at which they procure it, have so reduced their rates that it is questionable whether they are making a fair and profitable return upon their investment.

The time is sure to come when remodelling or reconstruction or expansion of business requires additional capital ; if provision is not made in times of prosperity to meet these conditions, it may be difficult in times of less prosperity to secure the needed funds ; it is, therefore, not advisable, for the sake of securing business, to reduce rates to such an extent that a proper return on the capital is not assured, otherwise you are courting self-destruction. There is a limit beyond which business competitors cannot go with continued safety to themselves without discrediting or reducing the profits of the very enterprises upon which their own prosperity depends.

A natural reduction in prices for lighting and power will be the result of developing business along lines being successfully advocated in some cities ; I refer to the limitation of the use of electric current for manufacturing purposes to the hours when there is practically no demand upon the supply station to meet the lighting requirements—in other words, to the daylight hours. The disadvantages of the peak load characteristic of practically all supply plants some years ago, and still of the majority of lighting and power plants, are known only too well to all of us.

A few years ago it was thought almost impossible to create and develop a commercial demand on a supply station supplying light and power, whereby the output would be practically constant during the ten hours generally referred to as "working hours." Yet this has been accomplished by a company with which I am associated in Montreal ; the ordinary day load of this company during the heaviest month of the year, namely, December, averages, between the hours of 7.00 a.m. and 6.00 p.m. from 90 to 94 per cent. of the maximum peak ; and you may be surprised to learn that this maximum peak load occurs with us between 6 and 7 o'clock in the morning when the city arc lighting overlaps the demand for power by the factories in starting up for the day.

The idea that it is profitable for many, if not all, manufacturers to work only during the daylight hours is gaining ground rapidly in Montreal and elsewhere ; the best evidence of which is the fact that contracts are continually being entered into which do not require the supply of all or part of the power during the hours when the need of illumination makes the greatest demand upon an electrical plant. By properly arranging the hours of work, a factory can comply with these conditions and yet not reduce the total number of hours of work per annum.

Power supplied to manufacturers under these limitations can be furnished at a cost very much less than they can ever expect to secure it otherwise, and at the same time there will be an additional demand for power created from sources heretofore incapable of being reached. This additional source of revenue will also permit of selling current for lighting profitably at a much less rate than when there is little or no requirement for the plant in the day time.

The papers to be presented deal with subjects of great interest and practical importance, and I solicit for them a full and thorough discussion. We are here principally to hear the views of members with whom we are not in constant contact, and to exchange ideas with each other ; let the discussion, therefore bring out all of the points not touched upon by the writers.

We are all engaged in an active and exacting business, and to prepare a Convention paper requires a considerable sacrifice of time. On behalf of the Association and the committee on papers, I desire to thank most cordially the writers who have complied with the request to present papers before this convention.

I desire to express my regret at not having been able to devote as much time to the affairs of the Association as I wished to during the past year, but the hearty support and co-operation of the Executive and other Committees and their attention to the matters entrusted to them has more than compensated for any lack of attention on my part.

I wish to thank you most cordially for the honor bestowed when you elected me your President, and for the support given me during the past year. I will close these remarks with the

assurance that I will always have a warm interest in the Association and stand ready to be of any assistance to it whatever that it may be within my power to render.

The President: I have just received a note that there are 76 members and guests present in this room. I think the members may feel very much flattered. It is rather a long way to come.

The next order of business is the Secretary-Tresurer's report, by Mr. C. H. Mortimer.

Mr. Mortimer presented his report, as follows:

SECRETARY TREASURER'S REPORT.

The Association year which has just closed has been marked by a substantial increase in membership. The membership now stands at 306, a gain since last report of 39.

Members who may change their addresses are requested to notify the Secretary. Owing to neglect in this matter, communications addressed to several of our members during last year could not be delivered.

Immediately following our last Convention, the attention of the principals of the various scientific schools in Canada was called to the Student Membership established by the Association at the Ottawa meeting, with a request that they acquaint their students in electricity of the fact. I regret that thus far no interest has been manifested either by the managers or students of these schools.

The Legislation Committee held several meetings prior to and during the session of the Ontario Legislature, when legislation detrimental to the interests of electrical companies was threatened. Fortunately, however, no legislation in amendment to the Conmee Act, or otherwise inimical to the electrical interests, was enacted.

A well attended and important meeting of the Executive Committee was held at the Windsor Hotel, Montreal, on January 10th last.

An offer was received from Mr. Frederic Nicholls on behalf of the Canadian General Electric Company, of the sum of $500 to the funds of the Association to be applied as the Executive might decide.

On motion by Mr. W. H. Browne and Mr. J.J. Wright, the offer was accepted, and set aside as a special fund out of which will be allotted yearly a sum not exceeding $75.00 for original papers to be presented by members of the Association at the Annual Conventions. A Committee composed of Messrs. Dion, Yule and Sangster, was appointed to draft rules and regulations, subject to the approval of the Executive, under which the prizes will be awarded. To the Committee on Papers was delegated the duty of judging the merits of the papers submitted, and the President was authorized to suggest to the Executive a suitable Committee to award the prizes.

Eight active and two associate members were elected at this meeting.

Mr. G.U.G. Holman, on behalf of the electrical companies and citizens of Quebec, invited the Association to hold its Annual Convention in that city. On motion of Messrs. J. J. Wright and A.A. Dion, the invitation was accepted, and June the 11th, 12th and 13th chosen as the dates for the meeting.

Committees to complete arrangements were appointed as follows:—

Committee on Papers—Mr. K. B. Thornton, Chairman with power to appoint the other members.

Local Committee—Messrs. G.U.G. Holman, Edward Slade and Edward A. Evans, with power to add to their number.

Committee on Transportation—Messrs. J. J. Wright, Frederic Nicholls and Edward Slade.

On motion by Messrs. Holman and Sangster, the matter of special financial assistance to the Local Committee was left in the hands of the President with power to act.

The President was requested to communicate with Mr. Francisco and ask that Canada be included in his statistics of the results of the operation of municipal plants.

Having learned of the presence in Montreal of Mr. Marconi, the celebrated inventor of wireless telegraphy, the Committee, on behalf of the Association, tendered that gentleman an informal luncheon at the St. James' Club.

The Secretary was instructed to record in the Minutes the pleasure derived by the members of the Association from the visit of Mr. Marconi and his kind offer, if possible, to be present and present a paper at the Annual Convention. The Treasurer was authorized to liquidate the cost of the luncheon.

Following is a detailed statement of the receipts and disbursements of the Association for the year ending May 31st, 1902:—

TREASURER'S STATEMENT

RECEIPTS.

Cash in Bank June 1, 1901	$276.47	
Cash on Hand June 1, 1901	14.27	
166 Active Members' Fees $3	498.00	
25 Associate Members' Fees $2	50.00	
Donation from Can. Genl. Elec. Co.	500.00	
Refund of part of grant to Local Committee for expenses of 1901 Convention	100.00	
		$1438.74

DISBURSEMENTS.

Badges for 1901 Convention	$ 11.75
Postage for 1901 Convention Programmes, etc	20.00
Exchange on Cheques	6.20
Express Charges	4.84
Telegrams	1.86
Stationary	3.10
Banquet Cards	1.00
Assistant to Secretary	3.00
Grant to Secretary	125.00
Expenses attending executive meeting in Montreal (for Secretary)	20.00
Convention Expenses (grant to Local Committee)	150.00
Ottawa Agency & Messenger Co	3.00
Stenographer	40.00
Luncheon — Tendered by Executive to Mr. Marconi	58.86
Printing in connection with 1901 Convention, including 400 copies of proceedings	122.58
Ribbon for Badges for 1902	2.10
Printing Show Cards for 1902	4.00
Postage	34.34
Cash on Hand	34.83
Cash in Bank	792.28
	$1438.74

Mr. Dion moved, seconded by Mr. Reesor, that the report be received and that the Chair appoint the usual auditing committee to audit the financial statement.

The President put the motion which, on a vote having been taken, was declared carried, and Messrs. A. A. Dion and John Yule were appointed as auditors.

The President: The next order of business is the presentation of the reports of the Standing Committees, and I will call upon Mr. Yule to present the report of the Committee on Legislation. I may say that the Committee on Legislation is one of the most important this Association has ever authorized to act in its behalf, and its work has been productive of most beneficial results, especially the protective legislation which has been enacted in the Province of Ontario. As yet there has been no unfriendly legislation enacted in Quebec, but it will come sooner or later, that is assured. At the recent Convention of the National Electric Light Association the matter of protecting the invested capital of electrical industries was taken up and the plans that were outlined as followed by the Canadian Electrical Association received considerable approval. I may say the State of Connecticut has followed almost identically the plans followed by the Legislation Committee of this Association. The legislation on this matter by the State of Massachusetts was before that time.

Mr. John Yule presented the report of the Committee on Legislation, as follows:

REPORT OF COMMITTEE ON LEGISLATION.

To the Canadian Electrical Association:

Gentlemen,—Your Committee on Legislation beg to report that during the past year they have given close attention to the interests of lighting companies in the department entrusted to their care by this Association. In looking back to the Niagara Falls Convention in 1897 when the movement was started to secure some measure of fair and just protection to the capital invested in Electric Companies, and knowing as we now do the extent of the agitation for Municipal control, it must be quite apparent to all and especially to companies in the province of Ontario that this Association has more than justified its usefulness and value. As this agitation has now developed into a socialistic propaganda of a far reaching nature, your Committee consider it will be a wise thing for the Companies interested to give a more active and liberal financial support to this Association if they value what has been accomplished in their interests. Our enemies are getting year by year more aggressive, and it will require constant watchfulness and work to hold what we have. Your Committee beg to be excused for repeating these arguments from time to time. We would be inclined to think it not necessary, but quite a number of companies have derived the full benefit of our work in the transfer of their properties to municipalities, who have not contributed one cent or given one hour's time in assisting the work of this Association. Your Committee earnestly hope and trust a more generous support will be accorded the Canadian Electrical Association in the future.

Reporting on the work of your Committee during the year, there was the usual grist of proposed amendments and new bills introduced affecting our interests. In the early part of the session deputations from municipal councils were in Toronto asking for changes in Section 35 of the Municipal Act, commonly called the Conmee Bill. At the urgent request of companies in the places represented by these deputations, the Chairman of this Committee took steps to counteract this movement, his action being approved by the Committee. The attacks made on Section 35 Ontario Municipal Act during the last session were not general but were made to appear as only affecting particular localities; of course if successful it would have affected the whole Province, Toronto and Rat Portage being the storm centres. As you already know the attempt on the part of Toronto City Council

although strongly pushed was unsuccessful. What they asked for was power to purchase energy at Niagara Falls or delivered in Toronto; they further asked for power to develop water-power. Their Bill gave no estimate of cost or any particulars that would name a limit to the contemplated expenditure.

The Socialistic candidates in the election campaign last month all advocated the policy of the Provincial Government generating electricity at the Falls, transmitting and selling at cost to the different Municipalities. Whether this movement will grow or not the future will determine. We point this out for the purpose of showing the different lines of attack made upon our interests and the necessity of continued wakefulness on the part of the Companies.

In the case of Rat Portage a compromise was arranged that was satisfactory to the Company and Council.

The question of assessment on the properties of the Companies was also before the Municipal Committee and an amendment passed to assess on their value as going concerns, or on the price at which the properties could be sold to others who would continue the business. The different interests were represented by able counsel but the strong agitation throughout the Province in support of a more oppressive system of taxation than is adopted to other manufacturing concerns appeared to influence the Committee in coming to this decision. The whole question of the re-arrangement of assessment has yet to be dealt with and a modification of assessment on Electric Companies may be obtained but the outlook in this direction is not encouraging.

The total amount contributed during the year was $297.00; there was deficit carried forward from last year of $7.72, this left available funds of $289.28.

The disbursements and unpaid accounts amount to $119.36, leaving a balance on hand of $169.92.

The number of Companies and individuals who have contributed this year is 31. Last year the number was 23.

The following are the names of those who have contributed: Exeter Electric Light & Power Co.; Strathroy Electric Co.; Mr. Breithaupt, Berlin; Hamilton & Prout, Forest; St. Thomas Gas Co.; W. H. Birchard, Aurora; Henry Cook, Hensall; Guelph Light & Power Co.; Brantford Electric & Operating Co.; Glenwilliams Electric Co.; Smiths Falls Electric Co.; R. A. Corbett, Port Hope; Renfrew Electric Co.; Ottawa Electric Co.; Listowel Electric Co.; Midland Electric Co.; Joseph Knox, Stayner; Seaforth Electric Co.; Galt Gas Co.; Gananoque Electric Co.; Ingersoll Electric Co.; Merrickville Electric Co.; W. C. Harrison, Norwood; Petrolea Electric Co.; Simon Plewes, Creemore; Knight Bros., Burk's Falls; W. Moore & Son, Meaford; Welland Electric Co.; Wingham Electric Co.; Leamington Electric Co.; Citizens Light, Heat & Power Co., Rat Portage.

JOHN YULE,
Chairman Committee on Legislation.

Mr. Yule: I might say since I prepared this report a week ago we got notice in the newspapers that there had been already a movement started to form a syndicate to develop power at Niagara Falls and transmit it to Western and Central Ontario. Whether it is a movement to force the Government into that action or what direction it will take I do not know. I beg to submit for your consideration the report of the Committee on Legislation which I have just read. (Applause.)

The President: You have heard the report of the Legislative Committee, and as this deals with the most important matter that this Association has taken in hand I think since its inception, we not only should pay attention to the report but will have to keep our eyes and ears open in regard to all the local indications looking to prospective legislation. We will consider the report at a later meeting. I will call on Mr. Adler to present the report of the Committee to confer with the Board of Fire Underwriters.

Alderman Sadler presented the report, as follows:

REPORT OF COMMITTEE TO CONFER WITH THE BOARD OF FIRE UNDERWRITERS.

To The President of the Canadian Electrical Association:—

The Convention of 1898 appointed a Committee to confer with the Underwriters with regard to the adoption of Permanent Rules Governing Electrical Installation.

The Committee made a report at the Ninth Convention held in the City of Hamilton, June, 1899. The substance of their report was that after several interviews with the Fire Underwriters, and a full discussion of the subject, it was held by the Underwriters, that they had not sufficient interest in the subject to warrant them in taking the matter up, especially if it entailed any extra expense to them of the appointment of an Inspector. The fires from electric wiring hazards did not warrant them incurring any extra expense.

The Association approved of the continuing of the Committee, but we are not aware of any further report having been made, or of any progress towards the appointment of an inspector of electric wiring, except that the City of Montreal a year ago in framing new building By-Laws, inserted certain rules governing electric wiring, and inserted a clause in this By-Law to the effect, that the City may appoint an Inspector, but nothing further has been done by the City. However, the subject has come up again by the action of the Fire Underwriters having on the 19th March 1902, sent a circular to the City Council of Montreal and caused the Montreal Board of Trade and Chamber of Commerce to also forward resolutions from their respective Boards, endorsing their action and urging the City to appoint an Inspector. Attached hereto are copies of these letters.

At the suggestion of your President we have undertaken to bring this subject before the Convention and report what has been done by the City of Montreal, since the receipt of these communications. The City Council passed them to the Fire and Light Committee, they were then forwarded to their electrician, Mr. F. H. Badger, to make a full report on the subject. At the present time Mr. Badger is visiting some of the cities in the United States with a view of ascertaining how the work is conducted there, and no doubt but his report will shortly be before the Council to take more definite action and decide whether they shall appoint an inspector or not.

There can be no question of the advisability of having an Inspector on Electric Wiring, but we would recommend that the work be divided into two classes: One pertaining to the wiring that is done outside on public highways and over roofs of buildings, the second the wiring inside the buildings.

With regard to the first there can be no question but that the city in the public interest and safety of the citizens and public in general, should have a supervision of the same and Inspectors.

With regard to the second, we cannot see who is interested outside of the proprietors and tenants of the buildings and Fire Underwriters.

We find on making enquiries that for some time back there has been established in Montreal an Electric Inspection Bureau. A Mr. W. J. Plews is the accredited Inspector of the Underwriters at this office. He issues certificates and collects a fee, but we cannot say if he receives any salary in addition, or what becomes of the fees. We attach to this report a copy of the certificates he gives which are printed in three colors,—white for the proprietor, blue for the insurance, yellow for the Inspectors' Bureau.

Thus it will be seen that the Fire Underwriters have been doing something in this line for their own protection, and we do not see any reason why they should not continue it, the question of expense to be settled between themselves and the parties they are inspecting for; of course it may be necessary to pass certain laws in connection with it.

We cannot discuss this question from an electrical point of view, but see sufficient in it to interest this Convention and leave the matter entirely for you, feeling sure you will take immediate steps to conserve the interests of the different companies supplying electric energy in the cities, and appoint a committee that may be prepared to meet the civic authorities to discuss this matter when it comes up later on.

[COPY]

Memorial from the Committee [illegible] Council of the City of Montreal re Supervision of Electric Light and Power Wires and Installations.

To His Worship the Mayor and Aldermen of the City of Montreal.

GENTLEMEN,—The use of electricity and the very hazardous conditions under which it is transmitted and used in the City of Montreal, with the resultant most serious loss to life and property, force upon us the urgency of having placed under control, as far as possible, the methods and material by which it is applied. We would therefore respectfully bring to your notice the following:—There are at present operating in the City the following Companies using overhead wire systems:— Lighting and Power Companies using High Potential Wires—Citizens Lighting & Power Company, Gazette Printing Co., Imperial Electric Light Co., Lachine Rapids Hydraulic & Land Co., Ltd., Montreal Light, Heat & Power Co., Standard Light & Power Co., Montreal Street Railway Co. Telephone, Telegraph, Etc.—Bell Telephone Co., Ltd., Canadian Pacific Railway Telegraph Co., Great North Western Telegraph Co., Dominion Burglary Guarantee Co., District Telegraph Co., Holmes Electric Protection Co., Merchants' Telephone Co., McGill College Time Line.

The mass of overhead wiring used by these Companies, particularly in the business portion of the City, strung upon poles, crossing over and supported upon the roofs of buildings, is a constant menace to public safety. As a rule the congestion is greatest in the proximity of the properties of largest values. Many wires become dead lines through the removal of telephones, messenger call boxes, etc.; in time they break, and are thrown by the wind into contact with high potential wires and become the medium by which many fires are started in concealed places.

The greatest danger exists from crosses between high potential wires and other wires. These wires are a serious hindrance to the Fire Brigade in reaching the upper portions of buildings.

At present any person, whether competent or not, is at liberty to instal wiring for lighting and other purposes, consequently a considerable percentage of the interior work is done with poor material and in a faulty manner. Many buildings were wired some years ago, with material and under systems of construction which have since been proven to be dangerous and to invite destruction.

Indicating and proving the danger from overhead wires, we have on record among others the following instances:

Canada Life Building. Robbins Apparel & Co. [illegible] sion current entered over electric time alarm wires, [illegible] connection with burglar alarm wiring, and caused fire to occur in material used in connection with safe protection.

Branch Bank of Montreal, corner of Seigneurs and Notre Dame Streets.—High tension current entered over burglar alarm wiring and burned out resistance coil, setting fire to woodwork in front of safe door.

Guarantee Co. of North America, Beaver Hall Hill.—High tension current entered over telegraph wires and caused incipient fire in vicinity of instrument.

Residence of the late W. W. Ogilvie, Esq.—High tension current entered over wires connected with messenger call box, setting fire to wall in vicinity of same.

Douglas Methodist Church, corner Chomedy and St. Catherine Streets.—High and low tension wires, stretched across roof, sagged and made contact with iron frame of skylight, thereby allowing high tension current to enter premises on low tension service wires. Current arced to ground, by way of insulating joints, which were used to connect combination gas and electric fixtures to gas pipes, and at a place where a wire was improperly laid across a lead water pipe.

Cold Storage, St. Henry Street.—Transformer was faulty, and allowed the entire voltage to pass into the building, causing very heavy damages.

Residence of Hugh Paton, Esq., Sherbrooke Street.—Primary and secondary wires touched, transmitted entire voltage around transformer, setting fire to the building and causing very serious loss. There were disturbances in two other houses in the immediate vicinity at the same time.

Guardian Assurance Co. Building, St. James Street.—The Burglary Alarm central office was located in the basement, by a voltage of 220 by the Standard Light & Power Co. Fire resulting from excess current and destroyed building.

It is a fact that concurrently with the fire in this building there were disturbances at the following places all served by the same system: Ness, McLaren & Bate, St. James Street, desk burned, etc; James Dennison, 141 St. Peter Street, disturbance; John Fee, 623 Lagauchetiere Street, disturbance; C. P. R. Telegraph Building, general disturbance, and there may have been others.

Warden King, Craig Street.—The primary current passed over service wire, transmitting current into the building—a man lost his life in consequence while attending the heating furnace in cellar of Dominion Foundry Supply Co.

St. Cunegonde—Alphonse Girouard.—Took hold of an incandescent lamp and died from the shock.

The above are a few instances among many that could be cited. The wearing and burning out of Transformers has frequently occurred. Electrial Experts have been consulted as to the conditions existing in the City, and they report them to be defective and hazardous to an extreme.

Having this knowledge, we earnestly request that steps be immediately taken by your honorable Council: 1st. To assume control of all wires and electric light and power apparatus within the City, and to regulate the quantity and voltage of current permitted to enter the City. 2nd. To have all light and power wires (and all others as far as practicable) placed underground, with the least possible delay. If the City has not the power to undertake or compel this, that they apply to the Legislature for same. 3rd. To require that protecting guards be placed over all trolley wires. 4th. To have dead wires removed without delay. 5th. To pass a law under penalty of which: a.—No transformer can be used that has not been inspected and approved of, and to provide for their examination periodically by competent and independent persons. b.—That all wires, conduits, and other material used be according to standard requirements. 6th. To have competent experts appointed as City Inspectors, as provided for in the Building By-Law, to see to the strict enforcement of the law contained therein regarding the use of electricity. 7th. To compel the production of certificates from the City Inspector, within a specified time by all proprietors, that the interior wiring is safely installed and in conformity with the standard rules. 8th. To take such other measurers as may be found necessary to fully protect life and property against the increasing dangers arising from the improper use of electricity.

Signed on behalf of the Canadian Fire Underwriters' Association.

JAS. McGREGOR, Vice-President.
ALF. W. HADRILL, Secretary.

MONTREAL, 19th March, 1902.

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THE MONTREAL BOARD OF TRADE.

Montreal, March 21, 1902.

To His Worship the Mayor and the Aldermen of the City of Montreal.

GENTLEMEN,—I have the honor on behalf of the Council of this Board to say that it has recently given attention to the questions of the dangers connected with the use of electricity for light and power, and that conference with the Underwriters' Association has convinced the Council of the hazards to life and property which have developed from the want of proper control of outside wiring and interior installation in this city. The Council therefore has unanimously endorsed the following requests which it understands the Underwriters are making to you.

That the City Council should: 1st. Assume control of all wires and electrical apparatus within the city, and regulate the quantity of voltage of current permitted to enter the city. 2nd. Have all light and power wires (and all others as far as practicable) placed underground, with the least possible delay. Should the city not have power to compel this that they apply to the Legislature to have it done. 3rd. Require that protecting guards be placed over all trolley wires. 4th. Have dead wires removed without delay. 5th. Pass a law under penalty of which: (a) No transformer can be used that has not been inspected and approved of, and to provide for their examination periodically by competent persons. (b)—That all wires, conduits and other material used be according to standard requirements. 6th. Have competent experts appointed, as provided for in the Building By-Law, see to the strict enforcement of the law contained therein regarding the use of electricity. 7th. Compel the production of certificates within a specified time by all proprietors, that the interior wiring is safely installed and in conformity with the standard rules. 8th. Take all other measures as may be found necessary to fully protect life and property against the increasing dangers arising from the improper use of electricity.

I have the honor to be, your obedient servant,

(Signed) GEO. HADRILL,
Secretary.

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LA CHAMBRE DU DISTRICT DE MONTREAL.

Having this knowledge, we earnestly request that steps be immediately taken by your honorable Council: 1st. To assume control of all wires and electrical apparatus within the City, and to regulate the quantity and voltage of current permitted to enter the City. 2nd. To have all light and power wires (and all others as far as practicable) placed underground, with the least possible delay. Should the City not have power to compel this that they apply to the Legislature to have it done. 3rd. To require that protecting guards be placed over all trolley wires. 3rd. We suggest that this clause be omitted as experience tends to prove that protecting guards, as used, are a cause of danger, either by increasing the number of wires in the streets or by loading unnecessarily the trolley wires with so-called protecting devices, which in countries where it has been adopted, has not rendered the services it was to do. 4th. To have the dead wires removed without delay. 5th. To pass a law under penalty of which: a: no transformer can be used that has not been inspected and approved of, and to provide for their examination periodically by competent and independent persons. b: that all wires, conduits and other material used be according to standard requirements. 6th. To have competent experts appointed, as provided for in the building By-Law, to see to the strict enforcement of the law contained therein regarding the use of electricity. 6th. To have certified electrical experts appointed, as City Inspectors as provided for in the Building By Law, to see to the strict enforcement of the law contained therein regarding the use of electricity. 7th. To compel the production of certificates within a specified time by all proprietors, that the interior wiring is safely installed and in conformity with the standard rules. 7th. To compel all proprietors to take permit before entering electric wires in buildings and to produce within a specified time a city inspector's certificate, that the wiring is in conformity with the standard rules. 8th. To take such other measures as may be found necessary to fully protect life and property against the increasing dangers arising from the improper use of electricity. 9th. No person to put up electric light apparatus in buildings unless he is a certified electrician, as provided in clause 6th.

(Signed) JOS. HAYNES,
Secretary.

Alderman Sadler: I do not propose to say anything on this question from an electrical point of view. I have no doubt you see sufficient in this report to interest you. Referring back to the time when the Committee was first formed, I think Mr. Dion, of Ottawa, was on that Committee with myself. I think I referred in our report to the fact that in our interviews with the Underwriters they did not seem to see anything especially hazardous in electric wiring. If you place that alongside of their present position you will notice there is quite a change. I would like to say also in connection with the appointment of inspectors in any of those lines, from my own experience in the City Council, there is often a possibility of being inspected to death. We can hardly do anything now without being inspected. While there is a good side to it, there is a bad side, and the individual's rights sometimes are very much interfered with. But perhaps one of the greatest difficulties is that when the city comes to want an inspector there are always a lot of applicants for the position, and it is the long pull and the strong pull that generally gets it, and it is not always the most competent man; in fact, experience shows that it is the incompetent man. When you take a man of that kind who is appointed to inspect, as we have to-day in sanitary matters, a matter on which the mind of the public is very much exercised, and the man is entirely ignorant of the business which he has in hand, and clothe him with a blue coat and brass buttons, and then have him discuss the question with other practical men of great experience, you can readily see it's a hindrance rather than the accomplishment of any good. I think it is from that

point largely in connection with electrical companies that the question of inspection should come up; and when it does I would urge that you use your influence as far as possible, if there is going to be a system of inspection, that the most competent man that can be got shall be appointed—a man perfectly independent of any of the existing companies, who cannot be bought in any shape or form, that will do right, and it will be very much in the interests of the electrical companies as well as the public at large. (Applause.)

The President: The report of this Committee is before you for discussion. It is hardly necessary for me to call the attention of the Association to the seriousness of having such alarming documents going forth from public institutions as those read by the Committee. I have no hesitancy in placing myself on record as saying that while there may be some foundation for some of the alarm expressed, the true spirit of that report from the Board of Fire Underwriters is for the purpose of relieving them from incurring such expense as they would be put to in connection with the establishment of a bureau of inspection. The report comes from my own city, and it may be more or less of a reflection on those of us who are in that city because we have been unable to bring the Board of Fire Underwriters around to view it from the point that it is viewed from generally throughout the United States and parts of this country. As stated by Mr. Sadler, when three years ago we interviewed the board of Fire Underwriters in Montreal with a view to having them establish a bureau of inspection, one of the managers of one of the principal companies in this country and England stated to me before the Board of Fire Underwriters that their statistics did not show a sufficient loss from fires directly attributable to electric causes to warrant their going to any expense to establish a bureau of inspection. He said, "your companies are responsible, you can form your own inspection." Since that time there have been some serious fires throughout the country, which by some are attributed to defective electric wiring. There is another serious matter that has come up in this connection; some of the insurance companies of Montreal, have taken an action for damages where there has been the slightest indication of a fire having been caused by defective wiring; and there have been brought some very heavy suits against some of the Montreal electric companies. There is one now pending for $120,000, and the attitude of the insurance companies at present indicates without doubt that that is the course they propose to pursue. We have got to take such steps as will protect ourselves against such unjust measures. I am speaking now from my knowledge of the conditions existing in Quebec. In Ontario I think it is somewhat better. I am going to ask for the views of some of the Ontario members as to the procedure of the Board of Fire Underwriters in that Province. I will ask Mr. Wright to let us have his views on this matter.

Mr. J. J. Wright: We have not had as much trouble apparently in Toronto from the insurance people as you appear to have had down in this end of the country. The Board of Underwriters in Toronto appoint inspectors who are supposed to look after all wiring installations in the interests of the insurance people. These inspectors, I believe pay themselves, but they tax the companies. We have to pay to the insurance companies a pretty good proportion (speaking now of my own company particularly) of the cost of the inspectors, our company I presume being the largest in the city. Some of the other wiring companies—small concerns—I think subscribe a small amount towards the expense of this inspection, but I believe we pay the major part of it. There seems to be no special tariff or tax; they simply come to us and say "Here, you want to pay some of this; it is through you we are put to this expense!" and rather than have any trouble we simply go down in our pockets and pay it. This inspector appointed by the Board of Underwriters inspects all new installations when wiring is done. The wiring contractors notify the inspector that the work is to be commenced on a certain building and he makes it his business to inspect the work that is in course of construction. He issues his certificates and there is a tacid agreement between ourselves as the operating company, the electricity producing company, not to supply current to any building until the insurance inspector has issued his permit. Should he be out of town or not available at the time, and the service urgently required, the Secretary of the Board of Underwriters usually grants permission to make the connection subject to the inspector's approval at as early a date as possible. That is the method adopted in Toronto, and I believe in most of the towns of Ontario, and we find it works fairly satisfactorily all round.

Mr. A. A. Wright: I would like to ask the gentleman who has just spoken if, when the companies get a certificate from this inspector, that relieves them from any legal damages in case a fire should occur in that building and it was alleged it had taken fire from electricity.

Mr. J. J. Wright: I don't know that it does. Very often in contracts for wiring the architect specifies that the work must be done in accordance with the rules of the Board of Underwriters. I presume it would relieve the companies from any action to be taken by an insurance company. If the insurance companies issue a certificate that they are satisfied with that wiring, I think it would debar them from bringing an action. But in regard to this question of damages we take precious good care to protect ourselves; we will not make a connection to any man's building unless we have a contract signed which contains a clause absolving us from any evil results of putting this current in the building. If a man won't take electricity on those terms he can't have it.

Mr. A. A. Wright: How do you do in the case of the tenant? Do you get an acquiescence from both?

Mr. J. J. Wright: There is a clause in the contract that the wiring used in that building is the property of the customer or consumer. If it is a tenant and the tenant signed the contract asking for light he acknowledges in that contract that all of the wiring is his property and he is responsible for it.

The President: Mr. Wright seems to be in a very happy and strong position where he can say to the customer take it for what it is worth. There are other people who are not in that strong position and you will find where there are three or four competing companies trying to get business in the same town, there will be one or two that are not willing to say that unless the wiring is strictly in accordance with the Fire Underwriters' rules they will not connect with it. I have in mind a very large public institution in one of our larger cities where the wiring was put in by employes of the institution, and it was put in in a most absurdly unsafe manner, a great fire risk and we promptly refused to connect; we were given 24 hours to connect on, or lose the business, and we lost the business, as it was taken on by another company. I have taken the position that the interior wiring of a house should as far as possible be under the entire care of the tenant. I know that is the way it is in England, and I don't see why the supply company should be any more responsible for the condition of the wiring inside a house than the water company is for the plumbing. When you have a valve or joint that leaks you don't run to the water company, you go to the plumber. There has been a great deal of discredit put upon many of the supply companies for the very reason that defective wiring for which they are not responsible is considered more or less under the care of the supply company. It is a pretty serious matter, and I trust it will receive the full consideration of the members here, or rather let us have a full expression of their ideas.

Mr. O. Higman: This cry against the danger of electric lighting should be stopped; it is unfounded and mischevious. I remember reading the statistics of of the city of London, for 1800 I think it was, as to the

number of fires that had occurred in the city and the causes from which they arose. I speak now entirely from memory. For kerosene it was 1200 odd ; gas 960 odd; and electric lighting 240. That comparison, as some know, was not well founded, but it shows how safe the electric light is as compared with the other systems of lighting, and I think the insurance people are certainly standing in their own way in making this trouble about electric lighting ; it is by all odds the safest light that we have. I know that on one or two occasions in Ottawa when the cry of fire caused by electric wiring has been raised that it was entirely without foundation. It seems to me that it is a matter that rests entirely with the insurance people ; they are trying to safeguard their interests and it is for them to meet the expense of the inspection. In England, as Mr. Gossler has already said, the interior wiring is under the entire control of the consumer and the supply company is not held responsible either for the condition or anything that might happen to the building caused otherwise.

Mr. J. W. Purcell: In the city of Detroit the city maintains an inspection under the public lighting commission; they charge the consumer for the inspection; or if the contractor who does the wiring makes an arrangement with the consumer to pay for the inspection he charges for the inspection. In the State they have an inspection; they charge the consumers right through. They have a regular price list and they charge according to that, and it is all set down in black and white; you know exactly what you are paying for and what you are getting.

Mr. Fred. Thomson: I think there should be some method of inspecting the contractors for electric wiring. We have in Montreal young men who do wiring who know no more about wiring than about flying. I think there should be some inspection of the contractors and the inspectors; that is where the danger comes in in wiring. I am in the business, and I have seen cases where there have been 56 amperes running on a No. 14 wire, and of course the wire was practically red hot.

Mr. Reesor: I think the way to get over that is for the companies to refuse to connect if wiring of that kind is being done.

The President: All companies won't refuse to connect on and the business is discredited.

Mr. Reesor: My experience in the town of Lindsay has been rather limited as far as the Underwriters are concerned. We have had but one fire that has been directly attributable to electric wiring; it was in a livery stable where there was a leaky roof, and the wiring connected to wooden cleats. When our attention was drawn to it we wired the place properly. But we have had no regular inspection. The inspector comes there periodically from the Underwriters' Association and makes such inspection as he thinks well and suggests any improvements or notes any defects and we fix them; but altogether I don't know that it has been very hard on our company. We had a visit recently from the representative of an individual insurance company; he was sent, so he said, from his company to inspect the risks that his company were carrying. He followed in the wake of the inspector from the Underwriters and in some cases changed what the Underwriters' inspecior had passed. It all comes back to us; it makes work for our company, and we get paid for it; we don't object to that at all. But the system they seem to have is not uniform. If the individual company's inspector acts one way and the Underwriters' inspector another it is difficult to know where we are at. As far as liability to accident is concerned outside of fire, we protect ourselves as far as possible by taking out an employers' liability guarantee; but fire accidents have been very limited; with that one exception I think we have had none.

Mr. C. Doutre: In connection with what was said, I understand the contractors of the city of Montreal are forming themselves into an association, and at the next session of the legislature they hope for incorporation of that association; they trust by that means to weed out the incompetents.

The President : Is that an organization or a union ?

Mr. Doutre : A union. They hope by that means to weed out incompetents, some of whom hardly know how to use a pair of pliers. In connection with the remarks of Mr. Higman, I think it is hardly fair to make a comparison of the wiring conditions in London and Montreal. I understand the wiring rules in London are very much more rigid than in the city of Montreal. I may say as far as I understand, there is really no inspection of electricity in the city of Montreal. Mr. Plewes' certificates, I understand, are accepted by the fire underwriters, but he is not their inspector ; in other words, Montreal is without an electrical inspector properly accredited to the Fire Underwriters' Association or the city of Montreal.

The President : They take the attitude that the supply companies are responsible.

Mr. Doutre : If you consult the Fire Underwriters' Association they will send you to the city ; if you go to the city council or the city electricians they will say, "We have no control over Mr. Plewes." Who is Mr. Plewes? He has an office down town and he performs inspection. I think it would be a very good move on the part of the companies operating to have an inspector appointed, and great care should be taken to see that a thoroughly competent man is appointed.

Mr. A. A. Wright : If there is a fire and they allege that it has been caused by the electric current, who do they hold responsible, the man who did the wiring or the man who furnishes current.

Mr. Doutre : I have never heard of any man who did the wiring who was held responsible, for the reason the man has no money to get and the company has.

Mr. O. Higman : The Institute of Electrical Engineers in England prepared the specifications for electric wiring and imposed these specifications on the municipalities ; it was given that power by law. No wiring contractor could deviate from the specification prepared by the Institute of Electrical Engineers. Now it remains for this Association in Canada to prepare a specification for wiring and see that it is carried out by act of the local legislature or some other body that can give it the power of law so that you will not be subject to the annoyances that you are.

Mr. Geo. H. Berg (Boston) : I do not know that you are aware of how they do things in Boston. Before a contractor can take the wiring in a building or before he is given the right to go ahead, he is obliged to pass a board of examiners at the city hall giving him the right to go ahead and do the wiring. He goes to work and does that work under the Board of Fire Underwriters' laws, which are acceptable to the city of Boston. When that contract is completed no current is allowed to be turned on until the contract has been inspected and the work accepted by the city of Boston ; and the inspector there cannot be bought. I have had considerable experience with him. That contractor as a consequence does his work right. (Laughter).

The President : Is that inspector a city or Fire Underwriters' official ?

Mr. Berg : He is a city official. He merely goes ahead and does his work under their laws. And then the company can't take and turn the current off. If you have a contract and say, " I won't put the current on until it is accepted," you can't afford to do that, the other company will do it.

The President : Where do the Fire Underwriters come in ?

Mr. Berg : They don't come in any more than the city of Boston works under the Fire Underwriters' laws. In that way we do away with and eliminate the irresponsible contractor ; that is, as Mr. Thomson says, any man that can swing a No. 14 wire can't go up there and do the work. You do not want to employ a man unless he is capable of doing that work and doing it right. In that way we have no trouble, either in turning the current on or from fires. I am under the impression that the contractors are held responsible for

defective wiring. I never heard of the company being held.

Ald. Sadler : I might say in looking up this question I have a communication from Boston, and I find that the city of Boston has what they call a wiring department ; there are thirty-one inspectors and a head to the department. I understand the head of the department has a salary of $5,000 a year and the inspectors $1,000 to $1,800. You see at once there is a lot of people to contend with, 31 inspectors, and have them all right.

Mr. Berg : It is very agreeable to do business with them ; you know when the work is done that it is right.

Mr. Sadler : Speaking as a consumer, in answer to what Mr. Thomson said about wiring, it brings to my mind a company which I am in where a short time ago the wiring was condemned by an inspector. We had to do some re-wiring and make some alterations. The board asked for tenders for these alterations that had been specified. They received tenders all the way from $25 to $75 or $80. There was a considerable variation between the lowest and highest tender, and while looking up this question of inspection I took upon myself to make some enquiries. I happened to know some of the parties making the higher tenders and I feel confident in stating that they were nearest the mark and were not making a fortune out of the work at $75. But, however, the company took the $25 contract, had the work done, got the certificate and went on with their lighting. Now, there is something wrong there ; who suffers or who is going to suffer I don't know, but certainly the consumer ought to have some protection. If there is a standard for wiring it would be an easy matter for the people doing the wiring and the consumer to meet on some level plane.

Mr. Dion : I think we are all agreed that there are things to be remedied ; that the relations between the people connected with electric wiring and electric supply, and the consumers and the Underwriters' Association are not what they should be, but the question is, how are you going to remedy it ? I am of the opinion that you will never get a proper system of inspection of wiring coming from the Underwriters. I came to that conclusion in the first interview I ever had with the Underwriters' Association in Montreal when I approached them as a member of the Committee of this Association, and I have had no occasion to change my mind since. They will make all the rules you want but they will not spend any money to get them enforced. Whether they have not the money to spend or whether they think the dangers to be avoided are not such as would warrant them in making any expenditure I don't know, but the fact remains that they are not disposed to spend any money for inspections, and I have lost any hope of our ever getting them to move in that matter. You must remedy the trouble either by provincial or municipal law. The city of Montreal may be averse to establishing an electrical bureau but it seems to me you will never remedy the present state of affairs until you have some law formulated either provincial or municipal, which will prevent any company connecting to a consumer's wires until the inspection has been made. I don't believe you could get a provincial act ; if you could it would be preferable. If you think you can get a municipal act passed it seems to me you should concentrate your efforts in that direction, together with the obtaining of a proper inspector. No doubt you run the risk of having an unsatisfactory inspector, but I fail to see any other way out of the difficulty. Do not look to the Underwriters ; they will not do anything.

Mr. F. Schweatmann, (St. Louis) : I hold that one of the very first things required is good rules. As a manufacturer of switches, I have tried for three or four years to get up a line of switches which would be acceptable to the Board of Fire Underwriters all over the United States ; I have absolutely failed to make such a line of switches. I find a switch after suiting probably one city would not suit another at all. It is absolutely impossible to have inspectors taken care of until you have taken care of the rules. Some cities are very much more careless in this regard than others, and until there is a general rule adopted, not only by the Underwriters but by the producers of electrical energy, to instruct your inspectors the same in San Francisco or New York, or in Toronto and Quebec, you will not succeed in getting any inspection that is satisfactory.

A Member : Do you consider the rules of the National Board of Fire Underwriters are comprehensive enough to cover the case ?

Mr. Schweatmann : Fully so if lived up to. Unfortunately I hold that there is 98 per cent. of all apparatus, switches and materials for wiring, that is made in the United States which does not come up to those rules and sell it you can't, because there is a lot of apparatus that is sold below that and accepted. I have sent a line of switches for three years to their Inspection Bureau and each time they had some suggestion to make, and each time I went into it to see if they would finally set a switch which they would guarantee to pass anywhere in the United States and they simply would not do it. After we had complied with all the rules of the Fire Underwriters, they still had some suggestion to make, and then they said that particular piece of apparatus might be good for several months but then they might add to their regulations and therefore it might be changed. We have a City Department and in this department we have inspectors, but they don't attempt for one moment to take care of the inspection. It is a very excellent institution, but it is only due to the quality of the local man, the inspector of the Board of Fire Underwriters. I daresay he will not pass anything but good work. The companies are trying to help him all they can and they will not connect without a certificate from him ; and while they do not help in a financial way they would gladly do so if there was a way of doing it. The customer pays for the inspection.

Mr. Holman : I want to say that my thought on the subject is, that we are in the process of evolution ; we are young at the business. I am personally acquainted with the particular rule Mr. Schweatmann has referred to, and that is that it requires 50 amperes per square inch of contact surface. We know that that is very large in the small switch and small in the large switch. This is true for certain small switches of 25 ampere capacity ; for switches of a larger capacity the reverse is true. It is simply a question of the business not having been evolved far enough. Then further, regarding inspections in New York City where there is an inspection by the city and another by the Underwriters and neither certificate alone is sufficient, I have had personal experience with that, and it is necessary to get both certificates. And the City is perhaps the most difficult one to get. In Philadelphia there is no City inspection or was not up to a few days ago at least. We took the certificate of the Philadelphia Fire Underwriters, which institution was conducted by the associated assurance companies. They had a graded system for charging and $2 was the lowest charge. The consumer and the wiring contractor generally took care of that. The electricity supply system did not pretend to take care of it. It is contended that the fault, if there is any, is the fault of the house owner and not of the energy producing company.

The President : I beg to differ with you ; I don't agree with you that we are young in the business.

Mr. Holman : I know that the General Electric Company was up against it and is up against it still with the other manufacturing companies, that a switch which is adequate for a certain capacity—where another capacity is required, the 50 amperes to the square inch, which complies with the rule, is not really sufficient.

The President : The rule may be insufficient, but I question about the experience being insufficient. If the rules have not been specific enough to cover all cases the rules have not been properly framed.

Mr. Holman : Perhaps it is a question of electrical

politics, because certainly the men at the head of the National Underwriters' Association who endorsed the rules of that Association and those who have conferred with them as representing the supply companies are pretty acceptable men and I think the difficulty is that there are certain differences and they have not got down to business.

Mr. Schweatmann: That is only one of the difficulties we have run against; there have been twenty-five more. I believe the National Board of Fire Underwriters are all right but some modifications should be made and some additions made. But it is not so much that, as the fact that they will not enforce the rules; and even if you make up apparatus conforming with their rules they will not guarantee that the apparatus will be accepted anywhere in the United States; and if a cheaper apparatus is accepted there is no inducement for a manufacturer to try and make an apparatus that will conform. The object is to make money by competing in the sale of apparatus; and if you attempt to compete with high priced good apparatus as against low grade apparatus and both are equally acceptable it is not much inducement to you. I hold that electrical manufacturers and producers of electrical current should get together and make rules which are acceptable to the Board of Fire Underwriters. Until you do, you have but very little hope of ever getting satisfactory inspectors.

The President: There have been no definite conclusions arrived at which will permit of our taking any definite steps. I submit that when the proper time comes this Committee on Fire Underwriters' rules should be continued and we will have to continue from year to year until such time as rules are evolved in accordance with our experience.

Mr. Yule moved that the report be received and adopted, the Committee continued, and a vote of thanks tendered to Alderman Sadler for his very able report.

Mr. Higman: I would second that, and in doing so would throw out a suggestion for the use of the Committee if they care to adopt it, and that is that we should work along definite lines by getting a provincial act. It is of no use leaving the matter to municipalities, because you will have a different condition of things in each municipality. What you want is a provincial law under which any municipality may pass a by-law and so put the act into operation. In that way it will have the countenance of law and you will be able to force upon wiring contractors right conditions.

Mr. Yule: You will never get a provincial law. The moment you introduce it they put you down as a grinding monopoly. You go to a legislature where they bring in an act or proposal to make the practice of medicine free to everybody, and you can't get a provincial legislature to pass any such law.

The President put the motion proposed by Mr. Yule and seconded by Mr. Higman, which, on a vote having been taken, was declared carried.

The Secretary read an invitation from the directors of the Canadian Electric Light Company to pay a visit of inspection to its power house at Chaudiere Falls and its sub-stations.

At the request of the President, Mr. A. A. Wright, of Renfrew, opened the discussion on the Report of the Committee on Legislation.

Mr. A. A. Wright: I didn't expect that I was to be called upon to say anything on this question; I did not hear all of the report; but you know we are told we should be always willing and ready to give a reason for the faith that is within us and being a good Christian I shall endeavor to do so. I may say that the report conveys to the members of this Association a very large amount of information, but I would also like to state, this Committee has done most valuable service for the upbuilding and carrying on of electric lighting in the Province of Ontario. I believe many institutions in the Province of Ontario have been saved practically their entire capital that they have invested, by the passage of that Act which was carried through successfully. It seems to me if every province in the Dominion would undertake to do the same thing it would be a good thing for them. I understand the province of Manitoba has carried through some legislation; I am also told one of the States in the Union has carried on similar legislation. The men who have had the looking after of this legislation in the province of Ontario have done most yeoman service to every man engaged in electrical work in the province of Ontario, and I am proud to say that nearly every one who is interested in that has responded fairly well in giving sufficiently to carry this work on. We do not want to let this thing lag; we want to have a sufficient amount of funds in hand for this committee so that whenever any adverse legislation comes up we can meet it at once. We know how it has served us in times past, and we know they are on the watch for us every day seeing where they can catch us napping. We have been very careful in the past and we have had good and sufficient men to look after this thing. All I can say is I hope that they will continue on in the way they have been doing and we shall try and assist them with our money. (Applause.)

Mr. Higman: There is just one mistake Mr. Wright has made, and that is in supposing that the legislation committee has met with very general support from the electric lighting companies. That has not been the experience of the Executive Committee. While quite a number have responded liberally to the invitation to support the work of the committee, there are a large number who have not done so. Now, it is very clear that all are reaping a benefit from the legislation that has been had, and from the work the committee is doing, and it seems to me there should be a more general response in a financial way to the needs of the committee. It is the smaller companies really that are reaping the benefit of the legislation that has been procured and I think it rests with them all to do something in the way of financial assistance. There is also the question of educating the people outside to the fairness of the position of the electric lighting companies. The press of the country is lamentably ignorant, it seems to me, as to the true position of affairs. The legislation that has been secured in Ontario has been taken from the English Act which applies to gas, water and electric companies in that country and sanctioned by the Board of Trade as a perfectly fair and reasonable proposition, namely, that those who have invested capital in concerns of this kind should receive a fair amount of protection and consideration. I maintain that the equity and fairness of the Conmee Act is beyond controversy. There should be no question as to the reasonableness of the position of the electric lighting companies to be remunerated or considered properly when the municipality wishes to step in and do the business that has been created by private investments.

Mr. Dion moved, seconded by Mr. A. A. Wright, that the report of the Committee on Legislation be received and adopted, and that the thanks of the Association be tendered to the members of the Committee, and that the Committee be continued.

The President, in putting the motion, said: The organization has been very fortunate in having its interests very well looked after in the past, and if its interests are looked after as well in the future as they have been in the past no fear need be entertained.

On a vote having been taken the motion was declared carried.

The President: I will call for the report of the Standardization of Accounts Committee, and I will ask Mr. A. A. Wright, of Renfrew, to present this report.

Mr. A. A. Wright: I am certainly very sorry that the chairman of this Committee is not present to read the report; also I am very sorry that the other member of the Committee is not here to read it to you, and that it falls upon the weaker and the innocent and aged member of this Committee to read it.

REPORT OF THE COMMITTEE ON UNIFORM ACCOUNTING.

To the Canadian Electrical Association :

GENTLEMEN,—Your Committee on the Standardization of Accounts for Electric Light Companies in submitting its report for your consideration regrets that its individual members being men very busy in their respective occupations may not have been able to devote in research the time necessary to do full justice to the duties that the Association has placed upon them.

As a preliminary to the work, your committee collected an array of blank forms the examination of which shows that these blanks and the treatment of expense accounts differ widely as between the different companies, and while possibly, generally speaking, the various companies charge the same factors to cost of production prior to paying dividends, it is a difficult matter to ascertain whether or not they do, and a lack of uniformity in accounting is here very much felt, almost every company having a different way of arriving at the Revenue and Expenditure.

In the examination of these blank forms your committee feels impressed that the prime object to be sought is not so much to go fully into the matter of books and forms, but to decide upon a classification of accounts under uniform headings and groups, affording an intelligent and simple means of comparison between companies and ensuring true statements of the cost of products.

With this prime object in view, your committee set to work, but before proceeding far, found that our sister Association in the United States had already taken up this work and that a similar Committee of the National Electric Light Association had already reported upon a Standard System of Accounts for Electric Lighting Companies. The system of accounting as set forth in such report was adopted by the National Electric Light Association at its convention at Niagara Falls in May, 1901, and by the adoption, as the president clearly set forth, it was meant that the system was to be put into effect by the members of that Association at as early a day as practicable. It is evident that the American Committee with funds at its disposal for expert research has gone into the matter in a thorough and business-like manner, and the system as submitted seems to cover the ground admirably, impressing your committee very strongly that it would be of material benefit to lighting companies in Canada, with our limited field, had we a system uniform with that of the wider field across the border. It was also found that one large Canadian company has been using with satisfactory results, a system of accounting very similar to the one now in question.

Your Committee therefore after careful consideration recommends the adoption of the Standard System of Accounts for Electric Lighting Companies as adopted by the National Electric Light Association in 1901. A copy of this report is appended hereto, and the Committee further respectfully suggests that copies of this report be obtained from the National Electric Light Association, or that same be re-printed with the permission of that Association and mailed to all members of our own Association, and that the adoption of this report if it is adopted, shall mean that it be put into effect at as early a day as possible whether it be this fiscal year or the next. In recommending the adoption of this report of the American Committee, it might not be amiss to quote the words of the President of the National Association when referring to that Committee and in which he says: "The Committee is composed of men that have been a lifetime in this business and I know of no men that stand higher in the field than they do, and I feel that it is perfectly safe for the Association to adopt this report."

Your Committee recognizes the fact that the Association cannot compel its individual members to adopt this uniform system, but its adoption can be strongly recommended and every manager of an electric light company must feel that it would be to his advantage, to benefit by the experience of some of the cleverest men in the business in the United States, as such men are who formulated the system now submitted.

Your Committee feels that it might not be amiss to here set forth in as few words as possible some of the reasons advanced showing the necessity for a uniform system of accounting. About two years ago a paper was presented at a Convention of our Association setting forth a system of accounting, and in the discussion that followed, a resolution was introduced whereby a Committee was authorized to form a Standard System of Accounts for Electric Light Companies that could be adopted by this Association, so that we might come together and compare costs, and if one central station manager was able to generate electricity at a less cost than another, it would be to the advantage of all to know just where the saving in cost of production is being made.

Furthermore, if the cost of production of the different companies was accurately known, and if managers of new and competing companies were able to obtain this information, it would without question sometimes prevent ruinous competition. Occasionally opposition companies start up, employing a practical electrician who possibly understands little of the financial part of the business, the Directors and their accountants themselves knowing nothing of the cost per kilowatt hour output, quote rates much lower than the old company, thinking as a newer concern with modern machinery and possibly a smaller capital invested, they should afford to sell cheaper; therefore, it is reasonable to suppose were they able to obtain from some central source, accurate reliable information, ruinous rates would be seldom quoted.

Then again, the feeling in favor of Municipal Ownership is growing very fast, consequently it is important for companies to be in a position to show municipalities and the public generally, that they are deceiving themselves in regard to the cost of manufacture and the large profits of the companies.

It does not mean if we keep our books according to this uniform system that a statement of our revenue or of the cost of our apparatus, or of the cost of producing current, need be given to the Public, to this Association, or to anyone, but the idea presents itself very forcibly to your Committee, that it would be an excellent plan if reports could be sent annually to the Secretary of our Association from all electric light companies, and that a summary of such in tabulated form should be available for members of the Association. It would not be necessary to give amounts and thus give away our business in any manner; such reports could be solely on a percentage basis and upon a form common to all, for instance—

Cost of Manufacture (Generating)
(State what percentage it bears to the Gross Revenue)
Operating.

1. Power Plant Wages (What percentage of total cost of generating)
2. Fuel for Power (What percentage of total cost of generating)
3. Water Power (What percentage of total cost of generating)

Etc. Etc.

Maintenance.

8. Maintenance of Boilers (What percentage of total cost of generating)
9. Maintenance of Engines (What percentage of total cost of generating)

Etc. Etc.

and in a similar manner for the different branches of expenditure. each division of expenditure showing what percentage it bears to the Gross Revenue; and each sub-division what per centage it bears to the total cost of that particular division of expenditure.

In this way it will be possible to determine where economies should be made in order to bring the cost down to a minimum, while giving a maximum efficiency of service to our customers.

Respectfully submitted,
D. R. STREET, Chairman
A. A. WRIGHT.

QUEBEC, June 11th, 1902.

Mr. A. A. Wright : We attach hereto a very interesting book which gives a valuable amount of information. I myself and the other members of the Committee have thought that it would be hardly possible for us to obtain and secure a better system than is laid down in this pamphlet, so clear and so concise, and it must be apparent to everybody that it is thoroughly efficient in its work.

The President: You have the report before you of the Committee on Standardization of Accounts. I think the organization owes a very great debt to this Committee for this report. The report is now open for discussion.

Mr. Dion: This is a very thorough report, and it offers suggestions of great importance to central station managers, and there are not very many in the room at the present moment. The report requires careful consideration; I would not like to see it thrown out or passed without further consideration or discussion or without some action being taken to carry out the suggestions contained in it. I would therefore suggest that the discussion upon it be postponed; we may have another opportunity of discussing it. I think Mr. Wright will agree with me it would be better to have a larger representation of the managers and the members responsible for the operation of central stations when this comes up. If this meets with the views of the members present now I think it would serve the interests of the subject better.

The President : I think that is a very good suggestion.

Mr. Holman : I beg to suggest that the system of accounting be made to include railway systems. As I understand it this Association is one of allied interests, and I think that an accounting system for railways should be incorporated in the report. The National Electric Light Association deals with the generating station.

The President :While this does not contain anything in regard to car service, the system, by modification, could be very easily applied to railway systems. It is very difficult to establish a standard system of accounting to apply to all localities, the same as with the subject we were talking about a little while ago. For myself I think the system as proposed in the report to the National Electric Light Association, a copy of which report is here attached, can be very much simplified

without sacrificing any good results. The report as put before the National Electric Association contained practically the system adopted by our ex-President, Mr. W. H. Browne. If Mr. Dion's suggestion meets with your approval I will proceed.

Mr. Dion : Before finally disposing of this matter I would like to say in answer to Mr. Holman that I understand from one of the members of the Committee on Accounting that the reason they did not consider the accounting of railway companies was that he understood that the railway companies of Canada had already adopted the American system or the system recommended by the American Street Railway Association, and that being the case there was no further regulation required in their case, and the Committee confined its report to electric lighting.

The President : Does the suggestion of Mr. Dion meet with the approval of the Association, that the discussion be postponed till we have a larger representation? (Voices : Yes.)

The President : If that is so I would suggest on the same lines that the Report of the Committee on Data be also postponed. I will now appoint Messrs. J. J. Wright and K. B. Thornton as a Committee to strike the Standing Committees for the year.

Mr. Dion : You remember that two years ago a Committee was appointed to revise the Constitution. This Committee did not make a report last year because it was not then in a position to do so, but some amendments to the Constitution were proposed and carried. The Committee has since continued its work, which has consisted in re-arranging and changing some of the wording of the Constitution rather than making any radical changes. The old Constitution can be amended in accordance with Article 10 in a certain manner, and it is necessary that a notice be given at this session of the Convention or at least that permission be granted at this meeting for the introduction of a notice of motion and that this motion be made at the next sitting, and that discussion on the amendments take place upon the following day. In order to carry this out it is necessary that this permission be asked for and granted now; that would allow the main question to be discussed some time tomorrow. We report as follows :

QUEBEC, June, 1902.

To the Members of the Canadian Electrical Association :

GENTLEMEN, — Your Committee appointed at the General meeting of 1900 to revise the Constitution beg to report that they have carefully examined the Constitution, and amended it in the light of the experience which has been gained in the many Conventions of this Association held since the old Constitution was adopted:

The amendments carried last year as to membership and fees have been drafted in. The changes consist mainly in covering points which the old Constitution did not provide for. We have made no radical changes, but rather a general re-arrangement of the articles and wording thereof for better form, and greater completeness and freedom from ambiguity. We do not wish to criticize the old Constitution which has done service, but the Association in its rapid growth had got beyond its scope.

Rather than recite at length the alterations proposed it will save time to proceed (under Art. X of the present Constitution) in the following manner, viz :

"We ask permission to introduce the following notice of amendment.

We the undersigned hereby give notice as provided by Art. X of the Constitution that we desire to amend said Constitution by substituting therefor the following amended Constitution in which reference is made to each Article which is changed thereby.

PROPOSED CONSTITUTION OF THE CANADIAN ELECTRICAL ASSOCIATION, 1902.

ART. I.—NAME (unchanged). This organization shall be known as " The Canadian Electrical Association."

ART. II.—HEADQUARTERS (old Art. XXVIII unchanged). The permanent office of the Association shall be in Toronto.

ART. III.—OBJECTS (old Art. II amended). The objects of the Association shall be :

(a) To advance the knowledge of the members in the various branches of applied electricity by holding meetings for the reading and discussion of papers and general interchange of opinion.

(b) To promote the professional and commercial interests of those engaged in any electrical work or enterprise.

(c) To foster friendly intercourse between the members.

ART. IV.—MEMBERSHIP (old Art. III and V amended).

(a) The Association shall consist of honorary, active, associate, and junior members.

(b) Active members shall be all those actively engaged in electrical enterprises (other than the manufacture or sale of electrical apparatus or supplies) electrical engineers and those engaged in matters of electrical education.

(c) Associate members shall be all others applying whom the executive committee consider eligible to become members of the Association.

(d) Junior membership shall be confined to students in electrical engineering.

(e) Associate and junior members shall be entitled to attend all meetings of the Association except those of the Executive, and take part in all discussions, but shall not be entitled to vote for the election of officers or be eligible for office.

(f) No person shall remain a junior member for more than two years, after which he may apply for active or associate membership.

(g) Honorary members shall be elected at any session of a general meeting by a two-third vote of the active members present.

ART. V.—FEES (old Art. V and XXVII amended) :

(a) The annual fee for active and associate members shall be $3.00. The Executive Committee however are authorized to increase the fee to a sum not exceeding $5.00 at any time they may deem it expedient in the interests of the Association.

(b) The fee for junior members shall be $1.00 per year.

(c) All fees are payable in advance and members in arrears for six months or more shall not enjoy the privileges of membership.

ART. VI.—OFFICERS. (Old Art. IV amended). The officers shall be a President, a first Vice-President, a second Vice-President, a Secretary and a Treasurer.

The President and Vice-Presidents shall be ex-officio members of the Executive Committee. The President shall be ex-officio a member of all other committees of the Association. The offices of Secretary and Treasurer may be held by one person.

ART. VII.—EXECUTIVE COMMITTEE. (Part of Old Art. IV amended). The Executive Committee shall be composed of ten active members, five of whom shall remain in office for two consecutive terms.

ART. VIII.—DUTIES OF THE PRESIDENT. (Old Art. XXII amended.) The President shall preside at all meetings of the Association, call meetings of the Executive Committee on the request or with the consent of three members of said committee and when directed by the said Committee call special meetings of the Association.

ART. IX.—DUTIES OF VICE-PRESIDENTS. (Old Art. XXIII amended). The first Vice-President, or in his absence the second Vice-President, shall in the absence of the President perform his duties.

ART. X.—DUTIES OF THE SECRETARY. (Old Art. XXIV amended). The Secretary shall attend all meetings of the Association, keep a record of proceedings thereat, notify members of their election and of all meetings, and perform such other duties as the President or the Executive Committee shall direct. He shall report at every Annual General Meeting on the state of the membership of the Association.

ART. XI.—DUTIES OF THE TREASURER. (old Art. XXV amended.) The Treasurer shall keep correct accounts of all cash receipts and disbursements, Assets and Liabilities of the Association, deposit the funds of the Association in a chartered bank approved by the Executive Committee, make all payments authorized by the Executive Committee, and no others, by cheques countersigned by the President. He shall submit at every Annual General Meeting a financial statement for the year ended the 31st. May preceding said meeting.

ART. XII.—DUTIES OF THE EXECUTIVE COMMITTEE. (old Art. XXVI amended.) The Executive Committee shall be the governing body of the Association, shall manage the funds of the Association which however may not be used for purposes of entertainment, pass upon all applications for membership and the eligibility of applicants subject to the Constitution and such other rules and by-laws which may be adopted by the Association from time to time.

ART. XIII.—MEETINGS. (new article.) The association shall hold a general meeting annually at a place to be selected as provided by Article XIV, and at such time as the Executive Committee for a term immediately preceding such general meeting shall decide, not earlier than 1st June. Special general meetings and meetings of the Executive Committee may be held as provided by Art. VIII.

ART. XV.—QUORUM. (old Art. XX amended.) Ten active members shall be a quorum for business at general meeting, and four members of the Executive Committee shall be a quorum for business at meetings of said Committee.

ART. XVI.—ELECTION OF MEMBERS. (new Article.) Active and associate members shall be elected by the Executive Committee upon written application signed by the applicants and countersigned by two active members.

ART. XVII. ELECTION OF OFFICERS AND EXECUTIVE COMMITTEE. (old Art. VI and VII amended.)

(a) The officers and members of the Executive Committee shall be elected by ballot at every Annual General Meeting, to hold office from close of said meeting until the close of the general meeting at which their successors shall be elected, except the five members of the Executive Committee who shall hold office for two such terms as provided by Art. VII.

(b) The election shall take place in the following order: 1. The President. 2. The First Vice-President. 3. The Second Vice-President. 4. The Secretary. 5. The Treasurer. 6. The five members of the Executive Committee who shall serve a

further term. 7. The other five members of the Executive Committee who may be any active members, including the retiring members of the Committee.

(c) The precedure shall be as follows:—

1. The Chairman shall appoint two active members to act as tellers, whose duty it shall be to collect the ballots, count the votes and report the results to the Chairman. A nominee for any office cannot act as teller for the election to that office.

2. The Chairman shall call for nominations for the first office on the list in preceding section (b) and allow three minutes for making nominations, after which he shall declare nominations closed, and no nominations shall be received thereafter. Any active member present may nominate any other active member for any office.

3. Every active member present shall deposit with the tellers a paper ballot bearing the name of the nominee for whom he desires to vote, and nothing else.

4. The tellers having reported the result of the vote, the Chairman shall declare elected the nominee receiving the greatest number of votes, unless such number be less than a majority of the votes cast. If no nominee receives a majority of the votes cast, the nominee receiving the least number of votes shall be retired from the contest and a new ballot shall be taken, repeating if necessary until a nominee shall have received a majority of the votes. This sub-section shall not apply to the election of the Executive Committee.

5. If only one nomination is received for any office the secretary shall deposit with the tellers a ballot which shall be deemed to represent the votes of all active members present, and the Chairman shall declare the nominee elected.

6. The procedure set forth in sub-sections 2, 3 and 4 of this section shall be repeated for the different offices.

7. In electing the Executive Committee a ballot will first be taken for the five members who are to serve a further term. The result of this ballot having been announced a second ballot will be taken for the other five members required to serve on the committee. In both ballots five names must be written on each ballot paper, and the five members receiving the greatest number of votes shall be declared elected.

(b) At the request of five active members made immediately after the result of any election has been announced, a recount of the votes shall be made.

(c) At the close of the sitting at which the elections shall be held, the President shall destroy the ballots.

ART. XVIII.—VACANCIES IN OFFICE. (Old Art. IX amended.) Vacancies in office from any cause shall be filled by the Executive Committee for the remainder of the current term.

ART. XIX.—COMMITTEES. (Old Art. XVIII and XIX amended).

(a) At every annual general meeting the members shall decide by resolutions what special committees, if any, shall be elected for the ensuing term.

(b) The chairman shall then appoint a committee of five active members to strike such committees.

(c) The report of such striking committee, which shall be submitted to the general meeting at the sitting following their appointment, may be adopted or sent back to the Striking Committee for reconsideration, but shall not be amended except with the unanimous consent of the striking committee, provided always that if any member named in said report refuse to act, the vacancy shall be filled immediately by motion.

(d) The adoption by the general meeting of the report of the Striking Committee will constitute the election of the special committes named thereon and all such committees shall serve from the close of the meeting at which they shall be elected until the close of the next following general meeting.

(e) The first named of any special committee shall be the convenor thereof. At their first meeting every committee shall elect a chairman for the current term, who shall thereafter be the convenor.

(f) All special committees shall make a report at the annual general meeting following their election.

ART. XX.—AUDITORS (new). At every Annual General meeting the Chairman shall appoint two auditors whose duty it shall be to audit the accounts of the Treasurer and present a written report to the Association during the said meeting.

ART. XXI.—ORDER OF BUSINESS. The following shall be the order of business at all Annual meetings. Time for general business, reading of papers and discussions shall be allowed between or after the following orders as arranged by the Executive Committee, said orders shall not be otherwise altered except by unanimous consent of active members present.

1. Reading and approval of the minutes of the last annual and intervening special general meetings.
2. Report of Secretary and Treasurer in consideration thereof.
3. Appointment of auditors in accordance with Art. XX.
4. Reports of Special Committees and consideration thereon.
5. General Communications.
6. Naming of Committees for succeeding term in accordance with Art. XIX section (a).
7. Appointment of Striking Committee in accordance with Art. XIX section (a).
8. Selection of place for next annual meeting.
9. Election of officers and Executive Committee.

ART. XXII.—RULES OF ORDER. (Old Articles XV, XVI, XII, XIII, XIV and XVII amended, Art. XI cancelled.)

(a) VOTING. 1. Every active member present at a meeting must vote, but any member who shall enter the room after the question has been put by the chairman need not vote. The chairman shall not vote except in case of a tie when he shall have the casting vote. Voting by proxy shall not be allowed.

2. Except where voting shall be by ballot the chairman will take the sense of the meeting by voice or by asking members to stand, but on call of three active members the Secretary shall record the yeas and nays.

(b) All motions must be duly proposed and seconded, and shall, except those of a purely routine character, be made in writing.

(c) No member shall speak under any order of business more than once or at greater length than five minutes on any question until all other members present shall have had an opportunity to do so, nor more than twice on any one question without the permission of the chairman. The mover of a motion shall have the additional right to reply.

(d) Any motion may be re-considered immediately after its adoption upon a motion to re-consider carried by three-quarters of the active members present. The motion to re-consider may not be discussed. The result of such re-consideration shall be final.

(e) The chairman shall decide all points of order. An appeal may be taken without debate against the ruling of the chair, a vote of two-thirds of the active members present being required to reverse the ruling.

(f) Todd's Parliamentary Practice shall be the governing law of the Association in all cases not provided for in its own Constitution or By-Laws.

ART. XXIII.—AMENDMENTS (old Art. X amended). Amendments to this Constitution may be made at any general meeting of the Association in the following manner:

1. Notice of proposed amendment in writing after having been submitted to the meeting shall be referred to a committee of five members appointed by the chairman.

2. Said committee shall report to the general meeting at some subsequent sitting thereof, said amendment in its original form, or with such alterations in the form as said committee shall deem advisable to make without altering the sense or purport of the amendment.

3. A two-thirds vote of the active members present shall then be required to carry such amendment.

A. A. DION.
J. J. WRIGHT.
JOHN YULE.

Mr. Dion: It requires the consent of two-thirds of the members present to allow this to go through, which does not commit anyone in any manner as to the amendments to be made.

The President: You have heard the notice of motion and in accordance with the Constitution a majority of two-thirds of the active members present must vote to give the necessary permission. I will ask those in favor of granting this permission to raise their right hand in order that I may count them.

On a vote having been taken the President declared the permission unanimously granted.

The hour of 12.20 o'clock p. m., having arrived, on motion of J. W. Purcell the Convention adjourned.

AFTERNOON SESSION.

At 2.15 p.m., special cars left the Chateau Frontenac, which conveyed the members and their friends to the car sheds of the Quebec Railway, Light and Power Company, where a paper was presented by Mr. A. B. Lambe, of Toronto, on "The Electrical Equipment of an Ordinary Street Car."

The President: The second session of the Association will now come to order and I will ask Mr. Lambe to present his paper. (See page 131.)

Mr. Evans: Mr. President, I take very great pleasure in moving a vote of thanks to Mr. Lambe for his valuable paper which he has just presented to us. I would like to direct the attention of the members to something which to us at least is a novelty. During the first two years we had some trouble with water getting into our cases. In the spring of the year we have to run through water up to our axles and the result was our cases got partially filled with water, although they are supposed to be water-tight, and it caused a good deal of trouble to our fields. We have bored a hole in the bottom of each case and since then we have had no trouble whatever. It is a suggestion which may be useful to other railroads.

The President: I am sure there are quite a number who will only be too glad to second Mr. Evans' motion.

Mr. F. H. Leonard: I second the motion, and in doing so I should like to express my appreciation which I have of the clearness and conciseness of the explanation Mr. Lambe has given us. I take a great deal of interest in the description myself, and I believe that others have solved a good deal that they did not

know before about electric car motors from hearing this dissertation.

The President: I am sure there will be no dissension from that vote of thanks so I will say to Mr. Lambe, the Convention gives you a vote of thanks for your valuable paper.

Mr. Lambe: I thank you.

The President: I am sure we all feel very much indebted to Mr. Lambe for his clear and interesting paper on an interesting subject. We are very fortunate in having on our programme another paper dealing with electric railways, so that at this convention the electric railway subject should be thoroughly exhausted as far as it can be in such a limited time. I will now declare Mr. Lambe's paper open for discussion, and I will ask Mr. Holman to make some remarks on the paper.

Mr. Holman: It is very hard; the President has put Mr. Holman in a very peculiar position. I feel something like the small boy who, when another small boy saw him eating an apple and asked him to give him a piece of the core, said, "There ain't goin' to be no core.". I feel somewhat that way about discussing Mr. Lambe's paper, it has been so concise and complete. Although not having been in the railway field actively for the last six years, previous to that time I was very much in it. The paper has been most admirably arranged and has been very clearly presented,ask Mr. Leonard has stated, and in trying to open a discussion on a subject which has been presented in such a general fashion, it is impossible to do so. One might ask for Mr. Lambe's views of how motors, according to his idea, should be rated; that is whether a 25 or 50 h.p. railway motor should be placed at 25 or 50 h. p. as the h. p. developed on the axle, under a certain temperature, or in some other way; in other words, there is a difference in the method of ratings, unlike the ordinary motor or generator. The discussion of details such as rating motors might take up another afternoon in addition to the time devoted to this discussion this afternoon. Personally I know of no questions to ask; I leave it to others. I personally desire to thank Mr. Lambe for his paper. (Applause.)

The President: Mr. Lambe has expressed his willingness to answer any questions you may wish to ask. I know the paper has been very complete and if there is no further discussion desired on this paper I will say that a motion for adjournment of the afternoon session is now in order.

On motion of Mr. Reesor, seconded by Mr. Leonard, the afternoon session was adjourned.

EVENING SESSION.

At 8.30 p. m., the President in the chair, called the Convention to order.

The President: We will open this evening's session by a paper by Mr. W. D'A. Ryan, of Lynn, Massachusetts, the subject of which will be "The Development of Arc Lighting Apparatus from 1801 to 1902, with Special Reference to Modern Arc Light Engineering." I have much pleasure in introducing Mr. Ryan to the Association.

Mr. Ryan read his paper.

The President: You have heard this very interesting and excellent paper of Mr. Ryan's; I will now lay the paper before you for discussion or remarks.

Mr. Thomas: May I ask Mr. Ryan a question on theory. Will you explain what is the physical nature of the transfer of the current from carbon to carbon; and also why it is, if I remember correctly, that when an arc is drawn between the carbons the current seems to be suppressed one way or the other?

Mr. Ryan: I really have not looked into that very carefully. We could talk practically all night on that.

Mr. J. J. Wright: I was just about to suggest, Mr. President, that as the time is getting rather late, perhaps it might be as well to postpone a discussion on this paper to a future session of the convention if there be an opportunity. At any rate in view of the fact that Mr. Ryan has taken evidently very great pains to prepare his paper and get the apparatus here and place it in working order, I would like to move that the thanks of the Association be tendered to Mr. Ryan for the excellent lecture he has just given us and for the immense amount of trouble I am sure he must have gone to in preparing to give us this interesting treat. (Applause.)

The President: Mr. Wright has moved a vote of thanks and I am sure you are all anxious to second it. I know that there will be no dissenting voices and I will declare that motion carried. I may say that there are some of the members of the Association who could enlighten us on the history of the development of arc lamps and arc machines. We have with us Mr. Wright who has just spoken and who has I think been associated with the early development of the arc lamp possibly more than any other man that I know of, and if it were not so late I would ask Mr. Wright to enlighten us on his experiences, which would be very interesting I am sure; also Mr. Fred. Thomson, in connection with the development of the arc machine. As it is quite late and especially as a great many of the members spent last night on the boats and trains, if it meets with your approval we will carry out Mr. Wright's suggestion to postpone further discussion on this paper and call it a close for to-night. There has been quite a number of the members making enquiry with regard to the system of decorative lighting in and around the tel, and there has been no general explanation of the system in use, and if Mr. Spaulding is here I will ask him to say a few words giving a general outline as to the rapidity with which this illumination can be used.

Mr. Spaulding, at the request of the President, at this stage explained the system of decorative lighting called the "Elblight," to which the members listened with a great deal of interest.

The President: I am sure the members of the Association are very much obliged to Mr. Spaulding and if there are no further questions a motion for adjournment is in order.

On motion of Mr. Leonard, seconded by Mr. Slade, the session was adjourned.

SECOND DAY.

At 10.15 o'clock a.m. the President took the chair and called the Convention to order. After the reading of communications the President said: We have with us this morning Mr. C. M. Green, who will present a paper on "Arc Lighting." I have the pleasure of presenting Mr. Green to the Association.

Mr. Greene: Mr. President and members: It gives me great pleasure to appear before you this morning. I would like to say that Mr. Gossler, your president, is a man whom I have known for a great many years, and he most assuredly improves on acquaintance; and he certainly knows how to handle things. I will now read you a paper on "Arc Lighting." (See page 136).

The President: Gentlemen, you have heard this most interesting and valuable paper by our very distinguished member and inventor, Mr. Greene. There are a great many here who are competent to speak of the development and operation of arc lamp systems of all forms, and I solicit for this paper a thorough and full discussion. The paper is now before you for discussion, and as there has been some reference to lighting in Toronto, I will ask our friend Mr. Wright to make some preliminary remarks on this paper.

Mr. J. J. Wright: Mr. President, I rather like this reference to arc lighting in Toronto. I was not aware that that was in the paper, not having had an opportunity of reading it before. Of course, in this world there are very many things we would like to have but which we can't get, and a revised and up-to-date system of arc lighting is one of them. There are a good many reasons why that is not attainable; the principal one, and one which especially applies to our case, seems to be that this lighting is done under contract with the municipality. The municipality has been endeavoring, as the bigger dog, to get away the bone from us for many years. The contract only extends for five years from time to time, and it seems as though that would

preclude any attempt at improvement in the arc lighting service. For instance, the contract that we have now with the municipality has three years yet to run. We could put in a very much more efficient arc lighting system than we have to-day but the cost of that change, and the interest on that cost, with the probability of an entire loss at the end of the period, would render it very inadvisable and would counterbalance the saving which might be made. Of course, when the time comes that power will be transmitted from Niagara Falls, which we look forward to in the near future, changes, of course, will have to be made. It is not likely that we should use our present generators in the shape they are, as they are of varying sizes and it would be almost impracticable to employ them with synchronous motors to any advantage, unless separate sized motors were used with each dynamo ; the method that would have to be used would be no doubt the synchronous motor and the constant direct current machine. Whether that would deliver current to open or enclosed arcs would be a question that would have to be determined by any contract or any arrangment that might be made with that impracticable body, the municipality of the city of Toronto. (Applause). All the points have been so fully covered in Mr. Greene's paper, it scarcely leaves room for any consideration of the matter from a scientific standpoint ; but no doubt there are many of the members who would be very much more able to take up that side of the case than I would. I would like to hear from them.

The President : Why have you come to the conclusion that only synchronous motors would be used in the operation of direct current machines? Induction motors seem to be left out of consideration.

Mr. Wright : There are two points I presume that would come up, one would be the question of power factor, and I think, speaking without experience, that in a long distance transmission from Niagara Falls to Toronto, ninety odd miles, supplying from the same line to different stations on the route, and branches and so on, that the disturbance to the line, the drop in voltage caused by the varying load would be so great that the synchronous motor would have the preference. The variation in voltage would not matter so much if the initial cycles were kept constant. The synchronous motor would stand a certain considerable amount of variation in voltage if it were large enough and still keep up its speed by keeping in step with the generators at the Falls.

Mr. Greene : The result arrived at in Buffalo is that the synchronous motors were cheaper than the induction motors, and one has a much higher power factor than the other and could be very readily controlled.

Mr. Dion : I think we are to be congratulated on the character of the papers which have been read at this Convention and the manner in which the subjects have been treated, inasmuch as after the reading of each paper it has been stated that the ground is so fully covered there remained nothing to be said. With regard to synchronous motors versus induction motors for driving arc machines, I do not propose to go into the subject to any extent, but merely to state that in our case in Ottawa we decided in favor of the induction motor. The power factor, of course, is to be considered, but an arc load is a constant load and a full load so that you are working under a full power load factor. But yesterday during the visit to the sub-station of the Quebec Railway, Light & Power Company, I had occasion to see the synchronous motors started, and I could not help making a comparison between the elaborate and grinding noises of starting used there to the ease with which an induction motor is put in operation.

Mr. Greene : I suggest Mr. Dion should visit Buffalo and Boston, where they are operating a great many synchronous motors where they are started up about as easy as the induction motors.

The President : I don't want to switch this discussion off, but in Montreal they are operating about 1500 to 2000 h. p. synchronous motor of the old type of machine. On the other hand, there is being installed a 5000 h. p. induction motor. If we had to put in new apparatus for arc lighting purposes we should put in induction motors. I would call for further remarks or discussion on this paper on Arc Lighting.

Mr. Lambe : I would like to ask a question as to the resistance of the arc. You get a voltage across it; what is that? Resistance?

Mr. Greene : As near as I can size it up I think it is pure resistance, but an extremely variable one. Take it upon the alternating arc current you get a voltage practically across at the identical same point, but the resistance of the arc depends so much upon the temperature ; it is affected by the temperature of the arc. I have never been able to get any indication of counter e.m.f. in the arc. I do not see any reason why there should be any. If there is any it might be a very nice way of getting electricity from heat. They have never succeeded in it, so I think it is simply resistance.

Mr. Lambe : What is the power factor of that arc itself in the ordinary 60 cycle alternating arc?

Mr. Green : One of the writers in his book gives the power factor of the arc varying from almost nearly one down to six-tenths. It depends very largely upon the grade of carbons which is used. Very hard carbons lower the power factor, conducting the heat away, making the resistance vary greater, whereas soft carbons conduct the heat away less rapidly and do not make the resistance vary so rapidly.

Mr. Lambe : If you have the power factor less than unity you must have condensation or reactance there, must you not?

Mr. Greene : You have a variable resistance which will give you a different power factor from unity ; that is, your resistance varies with your current (illustrates by diagram.) You have got a variable resistance there, the result of which is it will give you a power factor below one.

Mr. Martin : This is a very interesting subject to all of us, particularly managers of lighting stations, and Mr. Greene's paper has taken it up both from a theoretical point of view and also from a practical point of view which is interesting to the station men. I would say a short time ago I was called upon to decide for an arc lighting system for our own station and I started out ; I didn't like the look of the alternating arc light, it had its troubles ; a great many said the light quality was not pleasing. I returned a report in favor of c. c. arc, and I got myself very much disliked by the a. c. man ; he said I should put in a. c. I would like to ask Mr. Greene a question. Supposing we put in a 132 cycle alternating lamp or direct current, how do you compare those two? Are they favorable in comparison.

Mr. Greene: I don't quite understand.

Mr. Martin: Would you recommend putting in the high efficiency or 16,000 alternating arc or the direct current? How is the light quality or candle power?

Mr. Greene: The candle power from the alternating arc is less than from the direct current arc, slightly.

Mr. Martin: Has it less diffusion?

Mr. Greene: There is not the amount of light; that is, you don't get as many candle power. Take it from the candle power point of view, from your arc, and referring back to the diagrams given last evening in Mr. Ryan's paper, there is about five per cent. difference in candle power between a 450 watt alternating and direct current arc; that is, you get a little more light from the direct current than from the alternating; your distribution of your light is a little superior with your alternating, that is, you get more of mean spherical candle power; with your open arc lamp the curve will come down much lower, (illustrates by diagram.)

Mr. Martin: With the alternating arc light you get a better diffused light, but with the direct current you get a better light close by.

Mr. Greene: You get more light with your direct current than with the alternating. However, that is

comparatively slight; it won't amount to over four or five per cent.

Mr. Leonard, jr: Practically no difference. I do not like to lead up to an endless discussion, but I do not like to have the convention left with the impression that there is too much altogether in favor of the direct current arc system. I am personally very much in favor of the simplest and most uniform system that can possibly be arranged for central station purposes, and for that reason I have, as far as possible, in installations with which I have been connected, adopted the single alternating current unit. The advantages of having a single machine which operates all classes of service, it seems to me, outweigh so much any little advantages that can be obtained by a variety of different kinds of machines is sufficient to warrant the use of A. C. generators only, and I believe that the results obtained with the alternating current arc, certainly for street illumination cannot be excelled by the direct current arc. As Mr. Ryan brought out last night in his very complete and interesting paper, the general distribution obtained from the alternating enclosed arcs and direct current enclosed arcs are on a fair basis of equality, both being superior to the direct current open arc. We all know what the old direct current arc lamps gave us in the way of illumination; a heavy shadow, as was clearly shown last night, under the lamp, and an intense light at an angle of 45 degrees; a wide difference in the illumination or intensity of the light, making the illumination very unsatisfactory; a person driving under the light is first in deep shadow, then he drives out in an intensely brilliantly lighted space and his eye becomes so accustomed to that light that when he drives out into a little deeper shadow the illumination is most unsatisfactory. I had that experience for so long a time when I was in the central station business myself that I had it very deeply impressed upon me. The improvements made in the alternating current arc are very great. So far as the machine is concerned, viewing it from Mr. Greene's standpoint, it is very nice to push the machine with which you are connected and identified, and naturally, as a person connected with the working up to such a success as has been connected with the Brush multi-circuit machine, I don't blame him, and you can hardly get away from those things when you are so closely associated with them. But with the alternating arc you have the simplicity, you have the general illumination; you have, with the proper arrangements, the highest efficiency, I believe; you lose only about 2%, a trifle over, in your transformers; you have inductance regulation; you have a very small loss at full load, and the conditions of street lighting are such that the full load can be carried almost all the time, and the losses under these conditions are small; the generator efficiency is very much higher and the efficiency of the system throughout is great. The power factor is another matter that depends upon the load, but that is also very high under conditions of full load such as pertain to the ordinary street lighting system. I might say I know of a circuit which operates very satisfactorily so far as the illumination is concerned, where the power factor closely approached 90 per cent. with inductance regulation. I do not wish to go any further. I presume we could discuss this for hours.

Mr. Greene: I thank Mr. Leonard for his compliments, but I wish to right myself; I do not think he has quite grasped my conclusions. I would like to read the third one over again: "The alternating constant current enclosed arc system is best and most economical for plants which use large 40 to 125 cycle alternating current generators, the arc lamp load being a small part of the total output of the station."

Mr. Leonard, Jr.: That is correct. There is another point raised here, apparently not settled. Mr. Martin asked about the difference between 60 and 125 cycle arc. To straighten that matter out I would like to say that with the 60 cycle arc the power factor is very much higher than with the 125 cycle arc and the illumination is very little different; but the difference in the power factor is great; with the 125 cycle arcs, I think, so far as I have been informed, you are only able to obtain a power factor of about 67 and 68 and sometimes as high as 70, whereas 88 to 90 can be obtained with the 60 cycle arcs.

The President: It is to be regretted that we have not more time on our hands. On behalf of the Association, Mr. Greene, I convey to you the thanks of the entire assemblage for that paper and very much regret we cannot continue the discussion. I know there are many here who have a lot to say on this subject, and very feelingly too. If we have an opportunity before the convention closes I want to open up the discussion on this paper and also the relative merits of synchronous and induction motors for certain purposes. The next subject that we have before this Convention is one of vital and intense interest to us all; it is unnecessary for me to say that the work done by our fellow member, Mr. Thomas, is known all over the world whereever lightning protection is used or desired to be used in connection with the protection of transmission lines. The subject of the paper is "Lightning Protection and the Static Interrupter." I have great pleasure in introducing Mr. Thomas to the Convention.

Mr. Thomas: Mr. President and gentlemen: In some ways I am rather unfortunate in having such a subject; it is rather an uninteresting one and difficult to present, and if I have made it too concise and brief I hope you will all make notes and ask for further explanations when I get through. I have tried in the paper to give an outline of the phenomena taking place as the result of lightning discharges, describing rather closely how the results are produced, then, in a rather brief manner, a description of the static interrupter, which is the thing I wish to bring out as a new adjunct to the lightning arrester in the prevention of short circuits in high tension apparatus.

Mr. Thomas at this point read his paper (which will appear in a future issue) and illustrated his remarks by means of a mechanical model.

The President: I feel incapable of expressing my appreciation of such a paper as presented by Mr. Thomas with his beautiful mechanical model; it is beyond my powers and I will leave that to some of the more eloquent members. I don't believe I am going too far in saying that the originator of any device which is contributory to the safe and proper protection of our lines from lightning discharges, which may affect not only our business interests but come into our very houses, has conferred a boon upon mankind; and I think we will all agree that Mr. Thomas in working out this device which he has explained to us has been instrumental in presenting a unique and very great safeguard to the entire business. The paper is now before you for discussion. I see that Mr. Thomas has asked that there be expressions from different parts of the country in regard to the experience with static discharges and lightning protection. I know there are a great many here in the vicinity of Quebec and Montreal and throughout Canada who have had very extensive experience in the protection of long distance transmission lines, and I think the members of the Association will be very much benefitted if we can hear concisely the practical experience of the members on this subject.

Mr. Lambe: I want to ask Mr. Thomas a few questions. In the first place, a plant struck directly by lightning discharge is gone sure?

Mr. Thomas: I am quite sure time and again lines have been struck by the direct or half of the direct stroke without being shut down. I can take a moment here to describe one instance. The Colorado Electric Power Company I think has a worse condition in regard to lightning to deal with than perhaps any other line in the country. They run about 25 miles from Canyon City up to the Cripple Creek mining district, and where they are 10,000 feet above the sea level and where the lightning is an every day occurrence, and where it comes so regularly that they set their clocks by it. The superintendent of that plant told me a few days ago that on June 14th of this year, provided nothing happened between the time he was talking to

me and that time, they would have had a year in which they had not had the voltage off their line for a moment. They have one three wire line of 22,000 volts. They have frequently had their poles struck. I am quite certain they get direct strokes which jump their insulators and strike the pole and go to earth in that way, with the result that a secondary wave is sent along the wire to the apparatus. If, however, it is struck across close by the apparatus I don't believe there is much chance of it escaping.

Mr. Lambe : We understand then that the effect of an ordinary lightning discharge depends on where it strikes the line. Roughly speaking, what is the amperage and voltage of a lightning discharge?

Mr. Thomas : I remember that about ten years ago they used to do a little bit of guessing about that, but I have not heard of a case since that time.

Mr. Lambe : In crossing a body of water you have on the one hand a line crossing that body of water on towers or poles, and, on the other hand, a line going down underneath the river—which is the hardest to protect against trouble or which would give you the least trouble?

Mr. Thomas : I should not anticipate trouble from either method installed now, with a full knowledge of the conditions and with cable manufactured as it is at the present time. It just depends on the local conditions.

Mr. Lambe : Then we understand that for protection from lightning you express no preference?

Mr. Thomas : The cable is always a more sensitive apparatus, but I should not anticipate any trouble.

Mr. Lambe : As to grounding the neutral or secondary of a 110 volt system, do vou recommend it as far as lightning is concerned? Do you think it is desirable? Take a house circuit?

Mr. Thomas : It seems to me all those circuits which are liable to be touched by people, or which go around in wooden partitions, ought either to be grounded somewhere or equipped with a close set spark gap.

Mr. Lambe : In grounding that secondary, and having not only 110 volts for lighting, but take a power circuit of 5,000 or 10,000 volts, with a high potentiality of 30,000 or 40,000 volts, if you ground your secondary do you consider that increases the trouble on the primary lines.

Mr. Thomas : That is a matter to be considered in connection with the winding. If you have a 2000 volt circuit, if you are taking that from a 40,000 volt circuit, the difference between the earth potentiality and 2000 volts doesn't make much difference.

Mr. Lambe: The same thing would apply to grounding the neutral in high tension.

Mr. Thomas: Grounding the nuetral there introduces two sorts of effects; it prevents your getting more than say 6/10ths of the voltage between the line and ground. But one single ground produces a short circuit on the system. You have a certain advantage and a certain disadvantage. Which system is best depends on local conditions and on the voltage. Taking actual experience, I will say it is divided. I know of three lines, one of 40,000 and two of 30,000 volts in Colorado and California, that have not the neutral grounded. The plant of the Missouri River Power Company, 50,000 volts, is being put in without the neutral being grounded. Those who have grounded the neutral are in favor of it, and those who have not have managed to get along all right. I think probably on voltages as high as 30,000 volts it is wiser to ground the neutral point.

Mr. Lambe: There are two general methods of starting up a plant: Getting your voltage up to normal and then plugging in your switch; and then closing all your switches and turning on your throttle or opening your water wheel gate. In its effect on the line and transformers which do you consider is the best?

Mr, Thomas: Bringing up slowly, and, conversely, shutting down slowly.

Mr. Lambe: You would consider that of commercial importance?

Mr. Thomas: I think it is of commercial importance on anything above 20,000 volts. Where you have a high tension generator you must be more careful. The generator coil cannot be run in oil and the shape is so that you cannot put the amount of tension on. 10,000 volts is pretty near the limits.

Mr. Lambe : Barb wire, yes or no, do you think it is efficient as a lightning protector.

Mr. Thomas : That is one of those points on which we would like a little consideration ; that has not been electrically considered. A wire over the other is a protection ; if you can get a gridiron of wires, say a dozen, covering the lines and extending beyond, grounded thoroughly, I think you will get a very considerable degree of protection.

Mr. Lambe: You would not consider that it made any material difference whether it was iron, copper or aluminum?

Mr. Thomas : I think probably copper would be better. The protection against lightning disturbances is partly the absorption of the energy set up. If that is copper there would be more absorption. It is like it is a on a rotary transformer.

Mr. Lambe : What do you consider, generally speaking, the proper place to put your lightning arresters on the systems?

Mr. Thomas : Is this a power transmission system with its location of apparatus at the two ends or do you mean distribution through a city or town?

Mr. Lambe : A transmission system, more particularly?

Mr. Thomas : I only know of two or three cases where the protective apparatus is placed anywhere except at the station. Coming into the station from the line first could come the arrester, then the switches and busbars and so forth, if you have a sub-station on it at one side it should have its own protection. Occasionally where you have a district like Cripple Creek I believe it is well to have lightning arresters out on the lines.

Mr. Lambe what if you have a cable in your line?

Mr. Thomas : The protection of the cable is its protection against ground. You don't get any tendency to short circuit ; but in protecting against grounds you ought to have lightning arresters near the end of the cables.

Mr. Lambe : In passing over an unusually high hill is it desirable to have something?

Mr. Thomas : That depends on how severe the conditions are. If your apparatus placed at the end will not protect, possibly something over a hill will be better, as there are secondary discharges that are very great.

Mr. Lambe : Taking a secondary system around a town, a 2,000 volt primary, what protection would you provide there?

Mr. Thomas : There is a case where actual experience of the plant, if it is an old plant, would have a good deal to do. I think arresters ought to be placed from three or four to one or two to the mile near the greatest number of transformers, and if there are any on the line, at the end of the line. There will be a reflecting point ; you will have an increased potential there and it is a good thing to have an arrester there. The idea is that wherever a wave may be started it should reach the arrester before it is passed to any transformers.

A Member : Where there are high tension taps taken off and going from the junction point in several directions should you, besides having lightning arresters at each end, have one at the junction points?

Mr. Thomas : That would perhaps be a desirable thing it it is convenient ; I do not consider that especially necessary. Really that sort of thing is a safety in itself ; a wave comes down one line and strikes several different paths and it divides up, the energy does not all go in one direction.

A Member : Suppose a lightning discharge actually does hit the line, and supposing the line goes in differ-

ent directions, would it jump to the pole or follow one of the other lines?

Mr. Thomas: If it fell on that line it would reach the end if the insulation was sufficient, and if it was not it would break down.

Mr. Dion: I think we are fortunate in having amongst us a gentleman with the cross-questioning abilities of Mr. Lambe, because he has been the means of eliciting further information which Mr. Thomas has been very ready to give, and which has been of considerable importance to me, because I have secured information which I had previously been unable to obtain. I remember reading Mr. Thomas' paper which he presented before the American Institute of Electrical Engineers in which I think he stated something to this effect, that many transformers which were supposed to be destroyed by lightning from passage to ground were really destroyed by short circuit. It occurred to me to make some tests on transformers which were destroyed by lightning with us since that time, and in nearly all cases we failed to discover any contact with the case of the transformer at all, and we concluded the trouble was due to short-circuiting rather than a contact to ground. I asked myself the question, that being the case, whether we could not ground our secondary system without increasing the liability to burn out the transformers. Some time ago at the convention of the American Electric Light Association at Cincinnati where we had some gentlemen who have been connected with high tension work and who dealt with the problem of line protection, protection to transformers and so forth, I tried to elicit an opinion and I failed, and I am very much gratified to hear what Mr. Thomas has said. I don't wish to close this discussion, in fact, I don't pretend to discuss the paper; I don't feel capable of discussing it at all, but while I am on my feet I would like to move a vote of thanks to Mr. Thomas for his very able paper. I fail to find words to express all that I feel on the subject, but I think that we realize fully the amount of trouble and hard work entailed in the preparation of a paper of that sort and the transportation of this apparatus and setting it up and all that it involves. This Mr. Thomas has done for us, and the very least we can do is to pass him a very hearty vote of thanks. (Applause).

Mr. Wright: I second that.

The President: It has been moved and seconded that the convention convey thanks to Mr. Thomas for this very able paper. I hear no dissenting voice, so it is carried. Mr. Thomas, we present you with the thanks of the Association for your paper. Out of courtesy to Mr. Thomas, who has asked for the experience of some of the companies operating with the protection of barb wire, I am going to state briefly our experience with 35 miles of transmission lines running into Montreal. On these lines in crossing over two rivers under two canals and under the street we have two and one-half miles in five sections of cable. Mr. Thomas has stated cable protection is slightly more hazardous than straight line protection. I may say that that line has been in operation continually for four years without lightning protection other than barb wire. I don't wish to be understood as advocating running lines without lightning protection other than barb wire, as only where you can get good ground connection I believe the barb wire will be effective, but that is an experience that I think possibly Mr. Thomas may be glad to hear; and to those in charge of operation I would say we feel absolutely confident in the protection of barb wire as we have been running practically without lightning arresters other than grounded barb wire without the slightest indication of any discharge. I may say that the grounding in my opinion is very essential. We use three barb wires and ground every 90 feet, and the ground wire is connected to the barb wire by means of soldered joints, the ground wire extending down to the bottom of the pole and placed in the ground at the time the poles were erected, and is protected from mechanical injury by means of three-quarter inch wrought iron pipe running down. The experience we have is to us, at least, conclusive. We have had no discharge and we have had conditions there that are conducive to having a break down.

Mr. Slade: Do you send the linemen up with that barb wire on the pole?

The President: Not when it is alive.

Mr. Burran: In regard to barb wire, the Montmorency Company tried it; they had two parallel lines. They undertook to put barb wire on the ends of the cross arms extending out a little further than the line wires and above them; we grounded every fourth or fifth pole. During that season we had several very severe storms during the working hours, and we had no trouble on the line that was so protected. On the other pole line we had considerable trouble; so we decided we would equip the other line similarly that fall, which we did; and the following summer we had troubles on both lines indiscriminately, just as if we had never had a barb wire on them.

The President: I want to call attention to the fact that Mr. Burran states the poles were grounded every four or five poles. There have been several installations called to my attention grounded in the same way that have not been satisfactorily protected from lightning discharge.

Mr. Schweatmann: While lightning protection has been very ably discussed, I really believe that the lightning trouble is not so much the most serious to our high tension lines now as static discharges, and I believe the object lesson shown here by Mr. Thomas by his model is one we ought to bear most carefully in mind. If central stations will learn to appreciate that high voltage transformers have similar strains if switches are placed improperly to steam pipes and water pipes and all that sort of thing; and with a proper high tension line with proper interrupters or static dischargers, I believe we will do away with a great deal of our trouble. I am speaking from experience. I have seen most of the high voltage lines through Colorada and California and I have found that lightning is by no means one-tenth, I dare say 100th of the source of trouble, as it was five or six years ago; it is the static strains now, particularly on long distance transmission lines, that worry the producers of electrical energy. If we bear in mind the last few paragraphs of Mr. Thomas' paper and treat our high voltage lines with more consideration I think we will do away with a great deal of the trouble.

GENERAL BUSINESS.

Mr. Dion: Yesterday I gave notice in the report of the Committee on the Constitution of amendments which we proposed to bring before the Convention. It is necessary to be disposed of at this meeting that the formal motion be made to-day; I will therefore move, seconded by Mr. Wright, that the amendments to the Constitution of which we gave notice yesterday be passed, as you understand this is to remain on the table until some other sitting.

The President: I understand that matter must be referred to the Committee and not placed before the Convention. I will therefore refer this motion for amendments to the Constitution to the Committee which has had this matter in hand in past years, the members of which I am not quite familiar with.

On motion of Mr. J. J. Wright, seconded by Mr. Reesor, the session was adjourned.

THIRD DAY.

10.45 o'clock a. m. the President in the chair, called the Convention to order.

The President: The first matter to be attended to this morning is the election of officers for the ensuing year, but before proceeding with that I will ask Mr. Reesor, chairman of the Striking Committee, to make his report.

Mr. Reesor: Mr. President, the Select Committee to strike the standing committees for the current year beg leave to report as follows:

REPORT OF SELECT COMMITTEE TO STRIKE THE STANDING COMMITTEES.

Committee to confer with Underwriters: Mr. P. G. Gossler, chairman, Edw. Slade, A. A. Dion, Ald. Sadler, A. Sangster and J. J. Wright.

Committee on Statistics: Messrs. A. A. Wright, M. P., K. B. Thornton, D. R. Street.

Committee on Arc Light Rating: Messrs. Higman, Gossler, Thornton, Yule, Robertson and A. B. Lambe.

Committee on Legislation for Quebec: Messrs. P. G. Gossler, E. A. Evans, Geo. U. G. Holman, A. Sangster. With power to add to their number.

Committee on Legislation for Ontario: Messrs. Yule, Reesor, A. A. Wright, M.P., Hunt, Dion, Breithaupt, McCulloch and J. J. Wright. With power to add to their number.

Committee on Standardization of Accounts: D.R. Street, G. U. G. Holman, A. A. Wright, M.P.

The first named in each case to be convenor.

All of which is respectfully submitted.

B. F. REESOR, Chairman.

The President: You have heard the report of this Committee.

Mr. Reesor moved, seconded by Mr. J. J. Wright, that the report be received and adopted. Carried.

The President: I will ask Mr. Dion to report on amendments to the Constitution.

Mr. Dion: I regret the time is so short it will not be possible to go into this thing in detail. I beg to move, seconded by Mr. J. J. Wright, that the Constitution as amended be adopted. There have been quite a number of amendments made and it would take a long time to go through them, but as I stated before, they are amendments in form and in wording rather than in the sense, which has been left practically as it was before; and if you are satisfied that your committee, who have studied this thing very carefully and have had the matter in hand now for two years, have done what is best for the Association, perhaps you will be satisfied to pass the amendments without taking them up in detail. If, on the other hand, you think this matter should be taken up and discussed clause by clause by the general meeting, then it will be in order to lay the matter over until next year, because it would not be possible to do it this year. However, I make this motion and it is for you to decide what is to be done with it.

Mr. J. J. Wright: In seconding that motion I would say that if there is no objection to the amendments to the Constitution it would certainly be as well for this to be put through at this meeting; in fact, there is no change from the amendments that were determined on at the last convention. Those who were present at the last convention will remember the question of membership was taken up and it was divided into three classes and fees arranged and so on; there have been no changes whatever in those arrangements; they were all passed at that convention and simply crystallized in this new amendment to the constitution, so that if that is satisfactory to the meeting it would be very much better in the interests of the Association that it be passed now.

Mr. A. A. Wright: Who formed that committee, so that I may judge of their mental capacity?

Mr. Yule: I had the honor of being a member of that committee.

Mr. Dion: Mr. J. J. Wright, Mr. Yule, Mr. A. B. Smith and myself.

Mr. Yule: I had the draft for many days and went over it very carefully. The by-laws are made more modern and are more adapted to our present condition. I think the Association should pass them without losing any more time.

Mr. A.A. Wright: I might say if Mr. Yule endorses it I am quite satisfied it is all right.

The President: The matter has received very careful consideration from the Committee. I know that it will be to the interests of the Association to have this matter passed. I don't remember the exact wording of the motion, but it has been moved that the Constitution be amended and altered as per the report, according to notice given yesterday.

On a vote having been taken the motion was declared carried.

Mr. J.J. Wright: I would move, seconded by Mr. A. A. Dion, that the most cordial thanks of this Association be tendered to the following ladies and gentlemen and organizations: To the committee of ladies who have entertained the visiting ladies in connection with the Convention; the local committee who have had charge of the arrangements in connection with the present Convention (It is unnecessary for me to say anything as to how these arrangements were carried out and how satisfactory everything has been and the pleasure we have all derived from being present); to the Quebec Railway Light and Power Company, for their courtesy and the work they have done in ministering to the entertainment of the members; to the Jacques-Cartier Electric Company; The Canadian Electric Light Company; the members of the press for the reports given of the proceedings; Mr. Frederic Nicholls, Vice-President and General Manager of the Canadian General Electric Company for the excursion which we are to have this afternoon; the Corporation of the City of Quebec for the welcome extended to the Association; the rector of Ste Anne de Beaupre, Father St. Denis and Father St. Pierre, who so kindly received the members at the Shrine of St. Anne and went to the trouble of starting up the electric light plant for the entertainment of the members; to Mr. Langevin, the electrician of the Chateau Frontenac for his able assistance to the Local Committee in connection with the electrical illuminations; to Lieut.-Col. Wilson, R.C.A., and the Royal Canadian Artillery Band; to Mr. Russell Spaulding of the National Electrical Improvement Company, New York, who superintended the lighting decorations.

The President stated the motion and said he would like all to give their assent to it by a very hearty "yes", which was done and the motion declared carried unanimously.

Mr. Dion: I would suggest that the Secretary hand a copy of this resolution to the newspapers here in order that it may be properly inserted.

The President: We will take that as a suggestion.

Mr. J. J. Wright: Also I should have said that a copy of this resolution be forwarded to each of the parties interested.

SELECTION OF PLACE FOR HOLDING NEXT CONVENTION.

The President: Will any person here make any suggestion as to that?

Mr. J. J. Wright: As it seems nobody else wants it, I have very great pleasure in tendering an invitation to the members of the Association to meet next year in the city of Toronto. (Hear, hear). I know we are up against a hard proposition to put you up anything that will equal what we have received here in Quebec, but we will try. I will not say we will do better, but we will try to get as near to it as we can.

Mr. Dion: I move seconded by Mr. Leonard, that Mr. J. J. Wright's invitation to hold the next convention in Toronto be accepted.

The President put the motion which, on a vote having been taken, was declared carried, and Toronto fixed as the place for holding the Convention in 1903.

ELECTION OF OFFICERS.

The President: I will now call for further nominations for the office of President.

Mr. Dion: I have much pleasure in nominating the present incumbent of the office of 1st Vice President, Mr. B. F. Reesor, of Lindsay (Applause).

The President: Before proceeding to call for further nominations I may say according to the amendment to the Constitution, which amendment was passed last year, only the active members should vote.

The President: Are there any further nominations for the office of President? There being none, I will ask the Secretary to cast a ballot for Mr. Reesor.

The Secretary cast the ballot.

The President: I have great pleasure in declaring Mr. Reesor elected President of the Canadian Electrical Association.

The President : Nominations are now in order for the office of 1st Vice Presiden .

Mr. Dion : I have much pleasure in nominating Mr. Edward Slade, of Quebec, who is now 2nd Vice President. (Applause.)

The President : Are there any further nominations for the office of 1st Vice President ? There being none, I will direct the Secretary to cast a ballot for Mr. Slade as 1st Vice President.

The Secretary cast the ballot.

The President : I have pleasure in announcing Mr. Edward Slade as 1st Vice President.

The President called for nominations for the office of 2nd Vice President.

Mr. Yule : I have much pleasure in nominating Mr. K. B. Thornton, of Montreal, as 2nd Vice President.

The President called for further nominations ; there being none, the Secretary was directed to cast a ballot for Mr. Thornton as 2nd Vice President.

The Secretary cast the ballot, whereupon the President declared Mr. K. B. Thornton elected to the 2nd Vice Presidency of the Association.

The President : Nominations are now in order for the office of Secretary-Treasurer.

Mr. Purcell : I take pleasure in nominating for the office, our present Secretary-Treasurer, Mr. C. H. Mortimer.

The President called for further nominations ; there being none, Mr. Yule was directed to cast the ballot.

Mr. Yule cast the ballot, whereupon the president declared Mr. C. H. Mortimer re-elected to the office of Secretary-Treasurer.

The President called for nominations for the re-election of five members of the Executive Committee. Messrs. Robins and Fiske were appointed as scrutineers. TheP resident read the names of the Commit ee of last year.

The ballots having been distributed and a vote having been taken, the President announced the following five members re-elected to the Executive Committee : Messrs. J. J. Wright, A. A. Dion, John Yule, O. Higman and A. Sangster.

The President called for nominations for five additional members to be elected to complete the Executive Committee.

Mr. Yule placed in nomination Mr. P. G. Gossler.

Mr. F. Thomson placed in nomination Mr. A. A. Wright, M.P.

Mr. Dion placed in nomination Mr. F. H. Leonard, jr.

Mr. Leonard : In regard to my nomination, while I am eligible as designing and consulting engineer to membership on this Executive Committee, yet my connection with the manufacture of motors is such that I am afraid somebody else had better act. I beg to decline. I think the precedent has been established by Mr. Nicholls, who has taken the position that no one in the manufacturing or supply business should be a member of the Executive, and I feel very much as Mr. Nicholls feels. While I would be willing to do all I could to assist the Association and forward its interests, yet under the conditions I think I had better decline.

The President : Under the Constitution manufacturing members are not eligible to office. I think, Mr. Leonard, you are not eligible to membership on that committee.

The President called for further nominations.

Mr. Yule placed in nomination Mr. G. U. G. Holman.

Mr. Reesor placed in nomination Mr. F. C. Martin.

Mr. Dion placed in nomination Mr. John Murphy.

Mr. Fred. Thomson placed in nomination Mr. A. B. Smith.

Mr. J. J. Wright placed in nomination Mr. E. A. Evans.

Mr. Burran placed in nomination Mr. L. Denis.

Mr. Reesor placed in nomination Mr. H. O. Fiske.

Mr. Lamb e placed in nomination Mr. Wm. Bourne.

Mr. Reesor placed in nomination Mr. Gordon Henderson, Hamilton.

The President called for further nominations. There being none he declared the nominations closed.

The ballot having been passed and a vote having been taken, the President announced the following five members elected to complete the Executive Committee: Messrs. P. G. Gossler, E. A. Evans, A. B. Smith, A. A. Wright and G. Henderson.

The President called upon Mr. Dion to present his paper on "The Use of Storage Batteries in Electric Distribution Systems."

Mr. Dion presented his paper, (see page 128.)

The President : Gentlemen, you have heard this very valuable and interesting paper on a subject which many of us are not very familiar with. However, I see some here who have had quite extensive experience with storage batteries, and I will ask that they kindly give the Association the benefit of their experience when the paper is open for discussion. The paper as presented by Mr. Dion is now before you and I will ask Mr. Reynolds, of Philadelphia, if he will kindly open the discussion on this paper.

Mr. Reynolds : Up to the present time, I do not believe that the subject of storage batteries has received a great deal of attention in Canada. I presume that you are all aware of the fact that this has become a question of the greatest importance in the United States. I do not feel justified in discussing the paper which has just been read, because I represent the manufacturer, but I will be very glad to answer any questions and I hope I shall have such opportunity. I would like to consider with you the various systems in operation here. Years ago during the early development of the storage battery in the United States, the question of its use was influenced chiefly by the increased economy of operation. By improving the the load factor of the power station, obtaining a full load on the generator for 24 hours a day, and smoothing off all of the fluctuations, there is no question but that a saving ranging from 20 to 33 1-3 per cent. can in general be obtained. In Canada the chief proposition before you is water power, and I am convinced that the storage battery in the future is to be one of the most important adjuncts in the development of this power. As I have just said the chief point in view when storage batteries first opened in the States, was probably the idea of cutting down the coal consumption, and we found in approaching managers and engineers that this was the question which appealed to them most. Of course that point is indisputable, but one of the facts that appeals most strongly to the manager and engineer at the present time is the position which the battery fills as a relay in the station. A very interesting thing recently occurred in one of the largest lighting systems in the United States. In one of their stations in which a battery is installed, a steam pipe in the boiler blew out one day right at the time of the very heavy load. They allowed the steam to run down as low as possible, I believe to about seventy-five pounds. As the steam pressure dropped and the load on the generator sagged, the load on the battery increased until it finally carried the entire peak. They practically took everything out of the battery which was there but they got safely over the trouble and thus saved the day. There is another point, briefly, which I believe will appeal to you gentlemen in Canada probably more than any other, and that is the combination of lighting and railway interests in one ; from the standpoint of the transmission line and from the standpoint of the generating machinery. You take the case referred to in Mr. Dion's paper. This is the plant in Hamilton in which they transmit their power about 33 miles and distribute it to the street railways of Hamilton and to all of the lights. They are taking all that power and lighting from the same busbars at the substation. The battery absorbs all the fluctuation of the railway load, thus preventing the changes in voltage which would otherwise occur. We have with us Mr. Martin, who was

at one time connected with this Company and I hope that he will tell us something by actual experience of what has been done there. We visited the railway plants here in Quebec. They are running from large water wheels, with a highly fluctuating load and they get beautiful regulation. While I was there it was absolutely perfect, but I was impressed with the fact that everything was dependent upon the governor. If for any reason that governor should get out of order, the most serious trouble would result. There is one other minor point which I want to bring out which will connect with one of the previous papers referring to static discharges ; and that is the fact that the storage battery is an excellent lightning arrester. Where batteries are installed it is practically impossible to get a discharge through the generating machinery. The battery is next the line, and if the lightning gets that far it meets the enormous surface of lead plates and is dissipated. I am very much pleased to know that the Association in Canada has taken up the storage battery question, and I believe that the subject is one that cannot receive too serious consideration. It has become a question of the greatest importance in the United States, as is attested by the fact that from two to three papers upon this subject have been read before most of the Association meetings during the past two or three years.

Mr. A. A. Wright: Have you had any experience with and do you advise its use as in case 5 which Mr. Dion mentions where there is merely an alternating generator used.

Mr. Reynolds: I do not know of any installation employing a pure system of alternating current generation and distribution, in which a battery has been installed for the purpose of carrying a peak load. There are a great many stations where the power is generated by a large alternating current unit and distributed by alternating current and direct current for light and power. In such cases where a portion of this distribution is by direct current, batteries have been installed for the purpose of removing the peak from the direct current end of the system, and for regulating the fluctuations of this load. Upon such systems the battery is generally placed across the direct current end of the rotary or motor generator, and very often in times of emergency or trouble the rotary has been reversed, the battery running the direct current end as a motor thus supplying alternating current to the general system. I would not by any means recommend an indiscriminate use of batteries. There are many cases in which it would be poor policy to put them in, but I do think that each case should be investigated by itself and doubtless there are many systems in this country which would benefit largely by their introduction.

Mr. Thornton: I have a short communication from Mr. John Murphy, of Ottawa, and with your permission I will read it: "The statement contained in the eighth paragraph of Mr. Dion's paper is one to which I would like to direct especial attention. It reads as follows: 'So many successful applications (of the storage battery) have been made within the past decade that the electrical engineer cannot now afford to ignore the storage battery as a factor in the design of electrical plants for light or power supply.' In other words, a few years ago a storage battery installation was looked upon as the luxurious appendage of a power plant; to-day it is coming to be regarded as an absolute necessity; and, this is quite as true when applied to the financial side of the engineering problem as it is in connection with the successful operation of the plant. At the Niagara Convention of the Canadian Electrical Association, held in 1897, Mr. W. A. Johnson's able paper on the "Applications of the Storage Battery", and the discussion which followed its presentation, awakened anew the interest in this question which literature on the same subject had already created in the writer. Investigations covering the intervening period together with personal experience gained in connection with the operation of a storage battery plant, have made him as ardent an advocate of the use of storage batteries, in many cases, as if he were an accumulator manufacturer or one of his enterprising sales agents. A striking illustration of the noble manner in which a storage battery will come to the rescue of a generating plant occurred in Cincinatti during the recent Convention of the National Electric Light Association. A terrible storm occurred about an hour before noon on the morning of May 20th, and darkness prevailed to such an extent that even railway trains were compelled to stand still because all signals were invisible. All places inside and outside, required artificial illumination and as the storm, and consequent darkness, approached very rapidly, no provision for handling the enormous peak which immediately arose in the lighting load curve, could have been made at the power house at the time, but the battery which was installed at the centre of the city quietly discharged while the storm lasted, 5,000 amperes on each side of the three wire system—as shown by the recording ammeter charts—although the maximum overload rated capacity of the cell was only 4,000 amperes, and neither the users of light or the central station people were inconvenienced in the slightest degree. It is instances of this description, many of which on a smaller scale have been witnessed by the writer, that endears the storage battery to the central station man. In my opinion no street railway plant should be operated without an auxiliary storage battery. A street railway plant has naturally a variable load, and it needs an accumulator, which is analagous to a stand pipe in a city waterworks system, into which may be placed or out of which may be taken such an amount of energy as may be represented by a curve showing the extreme load changes. In this particular a storage battery has two very important bearings on the generating plant in regard to its first cost and in regard to its operation. The size of the generator and its prime mover, whether water wheel or steam engine, need only be large enough to supply the average load. If a battery is installed to take care of the fluctuations, and if the generator is steam driven the whole plant can be operated more economically when working under full load conditions, while if the generator is driven by water power the question of regulation is eliminated and energy may be stored during periods of light load and then distributed during such times as it is most needed. The constant load which is maintained on the wheels does away with the wear and tear on the gates and the jarring which the wheels and generator receive when operating without a battery. The astonishing results which have been obtained in maintaining absolutely constant pressure on circuits equipped with storage batteries, have been made possible largely by the designers of the differential booster and to them too much credit cannot be given."

Mr. Martin : I have had experience with our battery in Hamilton. It was put in particularly for regulation purposes, for the street railway, power and lighting, all off the same generator. We did start off with the idea of running two transmission lines so that we could keep our power and railway on one side and the lighting load on the other. We found that by using the battery we were able to regulate all off the same generator ; in fact we could regulate within two per cent. and the lights were very steady. The battery is a very useful thing in railway work ; in fact, lighting companies could hardly get along without it ; that is if they tried to work both services off the one machine. The batteries are used up there for starting the rotaries and for the car barns during the night hours. We had occasion to shut down our transmission lines once, to renew an insulator, and we kept up the street railway service for about 20 minutes with our battery. I think Mr. Dion's paper pretty well covers the matter ; and those interested in the battery question, if they go into it with some of the battery manufacturers, can easily demonstrate and bring the thing out very clearly, much more so than I could, showing its utility and value. But I must say in Hamilton the batteries have been in a year and a half and they practically do as well as they did when they were installed. One thing

about the batteries that we were anxious and frightened about was that we would not be able to keep them in good shape, that they would deteriorate materially. We found no trouble in Hamilton. The battery probably looks as well to-day as it did when we put it in first. We have been able to carry our railway loads in times of emergency when we could not have done it otherwise.

The President : Have you any direct current system aside from your railway service ?

Mr. Martin : We have a 250-volt power service which is not used with the battery at all.

The President : You use the battery simply for the railway ?

Mr. Martin : For the railway peaks.

The President : What capacity have you got installed ?

Mr. Martin : 400 ampere cells.

Mr. J. J. Wright moved, duly seconded, that the thanks of the Association be tendered to Mr. Dion for his paper on the storage battery.

The President put the motion which, on a vote having been taken, was carried amid applause.

The President : It is always to be regretted that we have not unlimited time when such an interesting paper as this is presented.

Mr. Dion : I do not want to take up too much time, but I would like to impress upon you the significance of what Mr. Murphy has said in his discussion on this paper. What Mr. Martin has said regarding the plant in Hamilton shows in a general manner all that the storage battery will do. I think the Hamilton plant shows the utility of the battery in all its different phases. But the value of the battery as an emergency reserve was never, to my mind, illustrated in such a striking manner as in the instance which Mr. Murphy mentioned. I happened to be there at the time in Cincinatti ; we had a sort of a cloud burst ; in the space of a few minutes it changed from day-light to almost absolute darkness, and just as he says, there was no possibility of getting the machinery started quickly enough to meet the demand for light ; they simply could not do it, and while they were trying to do it the storage battery was doing the work, and the recording ammeter showed that the battery had been discharged at 5000 amperes or 25 per cent. over its greatest rate or capacity. That impressed me very forcibly ; there was no accident, the storm went on and everybody had their lights ; there was nothing wrong, but if there had been no battery it would have been very wrong indeed. I find a great many people dismiss the storage battery subject by saying a battery costs too much, the first cost is terribly high, we cannot touch it. My plea was this, that you should not dismiss the subject in that way, but that you should take it up in connection with your plant and see what it does cost and possibly you can solve the problem in favor of the batteries, and if it results in economy, even though it is a very small economy, I think you should use the battery because you have the other advantages, better regulation, emergency reserve, and so on.

Mr. Lambe : Batteries are useful, I suppose, in connection with railway work. Would some member give us roughly the weight per h. p., the cost per h.p. and the average weight of maintenance.

The President : And may I add to that, I would like to know what the overloading capacity is ? Mr. Reynolds will you give us information on those points ?

Mr. Reynolds : In reply to your question, referring to the overload capacity of storage batteries, it will be necessary for me to know what you mean by that. I do not know whether you are all familiar with the ways in which batteries actually operate. In railway work it is very different from central station work. In railway work we have what we term "fluctuations," these being heavy changes of load lasting for a few seconds or a few minutes only. We do not term these sudden increases in loads "peaks." We apply the term peak to the long and gradual increase of load which you find during the heavy hours upon the average lighting circuit. For example : take the railway plant right here in Quebec. While I was standing yesterday before the ammeter, the load fluctuated from 200 to 1,500 amperes within two or three minutes. In a case of this kind we would determine the average load by taking a series of five or ten seconds readings. This average load only would be placed upon the generator, and the battery used to take the fluctuations above and below that average load. The result of this is that the battery actually discharges for a very short portion of the time only, although as usually installed it will have sufficient capacity to maintain a load represented by the amount of the fluctuations for a period of one hour continuously. Used in this way a battery has a very considerable overload capacity but it is impossible to state just what it is. In cases of emergency I have seen momentary overloads as high as 100 and even 200%. In central station work, the battery is installed for the purpose of carrying a peak lasting for several hours, and the output of the battery is therefore rated in actual ampere hours. For example, we have a peak which lasts three hours, and say it is equivalent to 4,000 ampere hours. Now, what the overload capacity of a battery installed for this purpose is depends entirely upon the size of battery installed. If a battery rated at 4,000 ampere hours is installed, its capacity should be considered exhausted upon the peak. It is advisable in installations of this kind to install extra plates in each cell so that a certain reserve in capacity is obtained, and of course this reserve represents what might be termed the overload capacity of the battery. Now, in regard to the other questions. In reference to the weight per horse power, we make so many different types that I can answer this in a general way only. We range anywhere from 60 pounds up to 300 pounds or more per horse power hour, taking into consideration our latest types of automobile batteries, and our heaviest types of central station batteries. The latter type, of course, we do not try to make light. The cost of batteries also varies considerably. Expressed in k. w. hours the cost of central station lighting batteries will range from $50 to $125 per k.w. hour, depending upon the size and upon the rate of discharge. In railway batteries it will range somewhere around $100, at the hour rate. I have seen it down as low as $85 and as high as $125. That is the complete cost, of course. As to the depreciation of these plates. There are in the neighborhood of 400,000 h.p. hours in batteries in operation at the present time in the United States. The depreciation of these plants depend within certain limits upon the conditions of operation, and I find that the human factor has a great deal to do with the cost of maintaining batteries. I have seen some batteries, which within three or four years show very considerable signs of depreciation, due to the abuse they have received at the hands of the man who is supposed to take charge of it, but I am glad to say that these are isolated cases. On the other hand many of our earlier plants, which have been in constant operation for seven or eight years show very little, if any depreciation. Our experience extending over 10 years and covering several hundred plants shows that when a plant is operated with ordinary intelligence the depreciation to be expected can be taken care of by an annual charge of not to exceed 6 per cent. It is only fair to state that the depreciation of a battery is affected by the amount of work it is called upon to do, and this figure of 6 per cent. is given upon the assumption that the battery will be called to do a normal amount of work. Were this amount of work materially reduced, the depreciation would be considerably lessened.

Mr. Lambe : That would not include maintenance ?

Mr. Reynolds : That is what we call maintenance. We do not consider there is any such thing as depreciation, and I was incorrect in using this term. If you put in a battery to-day, and at the end of four or five years you find it necessary to renew some of the positive plates, you necessarily will install plates of the most recent design, which will involve all improve-

ments of the four or five years. The result is that if the battery be properly maintained it is maintained up to the standard, and the battery has no depreciation. We call it maintenance, and that is really the correct term applied to a battery.

Mr. Lambe : Thank you.

The President : We are very much indebted for that information.

The President : I will call on Mr. Evans to present his paper, the subject of which is "Electric Suburban Railways". (See page 127).

Mr. Evans: I might preface my remarks by stating that the subject of the paper is more applicable to steam railroad managers than to an electrical convention; at the same time, it points out the great advantages of electric railways. With reference to Montmorency, I think it is important to mention that in 1901 the Kent House and all the property that we saw yesterday was not in existence; that is, the building was there, but it was not open to the public, and it had not been thought of as a place of resort for the citizens of Quebec, yet notwithstanding that you see we carried 64,000 passengers last year and only 17,000 the year previous.

The President: You have heard this very interesting paper, which we are all the better able to appreciate after our very delightful excursion of yesterday afternoon. While we naturally would conclude that rapid development of the road would have been made under the able management of Mr. Evans, it hardly occurred to me there would be such rapid progress as shown by Mr. Evans' paper which is now before you for discussion.

Mr. Evans: I might add for the information of the members one feature, that is the absolute necessity of having standard railway car-wheels M. C. B. standard. Of course, they are not suitable and you cannot run them over city tracks; the flange is too deep, but if you want a high speed suburban service it is absolutely necessary you should have standard wheels so that there is no danger of their running off the tracks at the different frogs and switches.

The President : You must have found it very much to your advantage to have put in the ballast you have there and the heavy rail?

Mr. Evans : Undoubtedly. That was one of the points I omitted to mention. Before we put in the double track we were operating on the old track, 56 pound rail, with ordinary old fashioned single fish plates. The traffic increased to such an extent that we had positively to double the track the first six or seven miles, and in doing so we put in 70 pound rails and a special fish plate three feet in length, double angle, an angle on both sides ; the result of that has been very satisfactory, so much so that my electrical engineer has tested the power taken in running the cars on both tracks. On the old track it takes 10 h.p. more to operate our 48,000 pound car than it does on the new track, showing the advantage of having the heavy rail and good joints, which, in my opinion, is more important than the heavy rail. The broken stone ballast whilst making a more rigid roadbed has proved very beneficial in bringing up the old track and also in adding to the life of the ties.

Mr. Reynolds : I would like to ask Mr. Evans a question in regard to the distribution of his power. Is there a sub-station on the road beyond the power house, or is all that portion of the road fed direct from the power house. I would also like to know how long this portion of the road is.

Mr. Evans : The power is taken from a 600 k.w. a. c. d.c. generator at Montmorency, seven miles from Quebec ; there on the d.c. end we distribute seven miles to Quebec and seven miles from Montmorency, making 14 miles direct distribution on that machine. We send a.c. current to Ste. Anne de Beaupre, 14 miles away at 11,000 volts ; there it passes through a 200 k.w. rotary transformer and feeds back seven miles in this direction or westerly to meet the d.c. current coming forward from Montmorency, and 7 miles easterly from St. Anne de Beaupre to the end of the line.

Mr. Thornton : Without wishing to stop any future discussion on this paper, I would like to move a very hearty vote of thanks to Mr. Evans for his interesting paper. The possibility of investments and profitable returns in suburban railroads and the results obtained with the enterprising management of Mr. Evans is a revelation to most of the members here present. There are many railroad men here and we would like very much to hear their opinions on the subject. Again, I would like to move a hearty vote of thanks to Mr. Evans for his paper ; it has been extremely interesting.

Mr. Dion : I second the motion.

The President put the motion which, on a vote having been taken, was declared carried with applause.

The President : If there is no further discussion on Mr. Evans' paper I will ask Mr. Yule and Mr. Dion to escort our newly elected President to the Chair.

The President elect, Mr. B. F. Reesor, was escorted to the chair by Mr. Yule and Mr. Dion amid applause.

Mr. Reesor: Gentlemen, I thank you for the honor you have conferred upon me in electing me as President of your Association,—the highest honor in the gift of the Association. I deem it an honor, and I felt a little timidity in accepting the office, but it seems to be so unanimous that I realize I will have the hearty cooperation of the executive and members of the Association, and I think we will probably be able to get along. I am extremely pleased that our next meeting will be in Toronto; it will be near our own home and we hope to see you all at that Convention next year with a large increase in the membership. I notice by the clock that we have very little time to spare, and if there is any more business to proceed with we will now take it up. I thank you again for the honor you have conferred upon me. (Applause.)

Mr. Dion : Mr. President, I would like to take this first opportunity after your installation to propose a vote of thanks to our retiring President, Mr. Gossler. You, as a member of the Executive Committee, know better perhaps than the members in general the zeal which Mr. Gossler has displayed in connection with his office. During the organization of this particular convention I have been closely associated with him, not as a helper to any extent, but we have been in very frequent communication, and I have been able to realize how very great a portion of the load he has had to carry and how much zeal and activity he has displayed and how much we owe to him for the success of this Convention, which is very great; and it gives me much pleasure to move this resolution which I have no doubt will be carried enthusiastically.

Mr. Leonard : I second the motion.

Mr. Reesor : I can assure you the Executive Committee and the officers have found Mr. Gossler a most indefatigable worker and hustler, as the saying is, from away back, and I am pleased that he will be on the Executive still, and I may say just here that I am very much gratified with the personnel of the Executive for the coming year. You have heard the motion that a hearty vote of thanks be accorded our late President. All in favor of that motion will signify it by standing up.

The members rose in a body, Mr. Leonard commenced, and was joined by the members in singing "For He's a Jolly Good Fellow," after which three cheers and a tiger were given for Mr. Gossler.

Mr. Gossler : Mr. President and members, I thought the time had arrived when I had escaped and would not be called upon to make a speech. I simply say I thank you very much, and wish to take this occasion, as I have personally, of thanking the committees and the entire Association for the support they have given me during the past year. I bespeak for our President, Mr. Reesor, the same enthusiastic support that has been given to me. (Applause).

On motion of Mr. J. J. Wright, duly seconded, the Convention adjourned to meet in Toronto in 1903.

SOCIAL EVENTS.

On Wednesday afternoon the delegates were conveyed by special cars to the substations of the Jacques Cartier Electric Co., and the Quebec Railway Light and Power Co., a halt being made at the latter company's car barns for the purpose of hearing Mr. Lambe's interesting paper.

By courtesy of Lieut.-Col. Wilson, R. C. A., the Royal Canadian Artillery Band gave a promenade concert on Dufferin Terrace, on the evening of June 12th. The delightful music, coupled with the beauty of the electrical decorations, drew to the spot thousands of the citizens who shared with the visitors the enjoyment of the occasion.

The trip by special steamer around the Island of Orleans visiting en route the docks, harbor and site of the new Quebec bridge, by invitation of Mr. Frederic Nicholls, Vice-President and general manager of the Canadian General Electric Co., proved most enjoyable, and brought to a fitting close the convention.

About one hundred members and invited guests attended the annual Association banquet at the Chateau Frontenac on the evening of the 12th June. Among those present were the following: Hon. L. R. Pelletier, Hon. G. Tanguay, C. Baillairge, H. M. Price, H. Reed, E. Pope, F. Carrel, O. J. Begin, J. J. O'Flaherty, Dr. Stewart, Dr. Phillips, P. Meyers. The tables were attractively decorated with flowers and miniature electric lamps. The President, Mr. P. G. Gossler, ably fulfilled the duties of chairman and toastmaster. The toasts were "The King" "The President of the United States" "Our Guests."

At 2 p.m. on Thursday a trip was made to the celebrated Montmorency Falls and the shrine of St. Anne de Beaupre. The train was in charge of Mr. Ed. A. Evans general manager of the road. At the falls an inspection was made of the generating station, from which current to operate the road is transmitted in both directions. This station has for many years been in charge of Mr. Lewis Burran, who was on hand to give all information. This was the first successful long-distance transmission line to be put in operation in Canada. When Mr. Fred. Thomson, then electrician of the Royal Electric Co., Montreal, suggested the possibility of lighting the streets of Quebec by arc lamps supplied with current generated at Montmorency Falls, he was the subject of much ridicule, which changed to admiration when he had successfully demonstrated the practicability of his ideas.

ELECTRIC SUBURBAN RAILWAYS.

By E. A. Evans.

A paper was recently read by Mr. C.H. Davis, C.E., before the Canadian Society of Civil Engineers, on the competition of steam vs. electric parallels, in which, among other conclusions, Mr. Davis took the ground that "steam railroads will, in the near future, handle their suburban and short distance interurban passenger traffic and mail, express, baggage and light local freight carried in said suburban and interurban passenger trains by electric motive power; and this, irrespective of whether operating expenses are affected favorably or unfavorably." In this conclusion the writer firmly agrees, and proposes to show that to carry out this conclusion it is not even necessary to construct a parallel, but on the contrary, steam trains and electric cars can be safely operated upon one and the same track.

The writer (as manager of the Quebec Railway, Light & Power Company, part of which company was formerly the Quebec, Montmorency & Charlevoix Railway, a steam road operating between the city of Quebec and Ste. Anne de Beaupre and St. Joachim, a distance of 30 miles,) inaugurated a service of electric cars upon the same track and running between the usual steam railway service. The scheme was generally considered a bold one and one that would not meet with the success anticipated; the results, however, as will presently be shown, have more than justified the innovation and the expenditure incurred.

The Quebec, Montmorency & Charlevoix Railway, as it was formerly called, after leaving Quebec, passes along the flats comprising the north shore of the River St. Lawrence; for six miles there is a continuous row of farmers' and other dwellings running on both sides of the highway, which, however, is on the top of a cliff running parallel to the railway and at a distance varying from one half to one mile from the track; at Montmorency, the line runs through a small village, the inhabitants of which are mostly operatives in a large cotton factory, and from here the line runs through the following parishes:—L'Ange Gardien, population about 1,500; Chateau Richer, population about 2000; Ste. Anne de Beaupre, population about 1500 and St. Joachim, population about 1000. Before the innovation of the electric system, this population were served in the winter by two daily steam trains leaving Quebec at 8.50 a.m. and 5.15 p.m. and leaving Ste. Anne de Beaupre at 7.15 a.m. and 11.40 a.m. In the summer by four daily steam trains, leaving Quebec at 7.30 a.m., 10 a.m., 5 p.m. and 6.15 p.m. and Ste. Anne at 5.45 a.m., 7.23 a.m., 11.50 a.m., and 4.10 p.m. There was also an additional steam train between Quebec and Montmorency, leaving Quebec at 2 p.m. and returning at 3.45 p.m. Special trains, as required, were also put in service to convey the large numbers of pilgrims visiting the Shrine of Ste. Anne.

The residents in the thickly inhabited portion on top of the cliff, between Quebec and Montmorency, previously mentioned, did not patronize the railway, but travelled by omnibuses, of which there were eight or ten.

In the year prior to the introduction of the electric cars, viz., 1899, the steam trains carried 253,054 passengers, including about 41,500 pilgrims to Ste. Anne de Beaupre. This did not appear to the writer to be satisfactory, especially during the winter, when residents would take advantage of the good winter roads and drive, rather than have the inconvenience of having to wait and be at a railway station at a certain fixed time to catch a train. As a result it was decided to electrically bond the existing track, put up an overhead trolley wire, high enough to allow of brakesmen travelling with safety on top of box and freight cars, put in an A. C., D. C. generator at the electric power station at Montmorency, and operate electric cars between the steam trains. These cars were each equipped with four 50 h. p. motors and Westinghouse air brakes, operated by an independent motor, and were so geared as to be capable of running at a speed of 45 miles an hour, standard railway car wheels being used.

The cost of this work for the 30 miles of track was as follows:

Electrically bonding existing track	$ 5,022
Overhead trolley, including poles, etc.	68,804
6 large double truck cars, seating capacity 54, with motors, etc., complete	51,606
One 600 K. W. A. C. D. C. generator and water wheel and one 200 k. w. rotary transformer at St. Anne, including switchboards, etc.	43,943
	$169,375

Upon its completion, in addition to the regular steam railway service, which was continued as before, cars were sent out between Quebec and Montmorency every hour between 6.30 a.m. and 9.30 p.m., and between Quebec and Ste. Anne de Beaupre about every three hours, and the following comparative statement shows the result of the year's operation in 1901, from which it will be noted that there was an increase of 218,320 passengers carried and an increased revenue of $29,071.39, with an increased expenditure of $5,698.46. From 30th June, 1901, to date, (12th June, 1902), there has been a further increase of 86,392 passengers over the corresponding period of last year.

Comparative Statement of Tickets Sold at Different Stations.

	1899 Steam		1901 Steam and Electric.	
	Passengers	Amount	Passengers	Amount
Quebec	108,103	$20,107.20	259,364	$33,976.70
" Pilgrims	41,329	7,687.35	106,280	13,922.34
Headleyville	2,431	452.30	4,759	623.45
Beauport	20,241	1,626.25	47,237	4,991.40
Montmorency	17,070	2,963.60	64,535	6,594.31
L'Ange Gardien	11,062	1,427.10	15,669	2,048.25
Chateau Richer	12,652	2,274.25	18,885	2,879.70
Ste. Anne	23,738	4,569.45	33,190	5,404.55
Beaupre	2,198	463.60	3,691	611.50
St. Joachim	2,920	563.00	10,557	1,596.62
Agencies	11,310	2,087.45	7,207	944.12
Totals	253,054	$44,221.55	571,374	$73,292.94

The operations for the year 1900 are omitted, as the work of electrifying the road was only partially completed.

The omnibuses previously referred to have been run out of business, notwithstanding the inconvenience of passengers having to walk up the cliff to get to the public road and their houses, and traffic has now so much increased that it has been found necessary to run cars every half hour between Quebec and Montmorency and about every hour between Quebec and St. Anne; and in addition the steam trains are run as formerly. On Sundays and holidays the resources of the Company are so fully taxed that it has been found necessary to increase the rolling stock with cars having a seating capacity for 120 passengers, and in addition to the regular cars, to run specials at from ten to fifteen minutes interval. It has also been found absolutely necessary to construct a double track between Quebec and Montmorency.

The writer, as an old steam railway engineer, would like very much to enlarge upon the subject of suburban railways and the desirability of steam railway managers studying and taking up the subject, but sufficient has, however, been said to show that it is advisable and in the interests of their companies to leave the old groove and not to allow other and independent street railways to compete for suburban traffic. It might perhaps be as well to mention that notwithstanding the traffic above mentioned, steam freight and special pilgrimage trains are being constantly handled and that no collision or any other accident has so far occurred.

THE USE OF STORAGE BATTERIES IN ELECTRIC DISTRIBUTION SYSTEMS.

By A. A. Dion.

The writer's experience with storage batteries in the early years of their commercial application, when little was known as to their limitations and too much was expected of them, while it made him fully acquainted with their inherent defects, some of which have since been partly remedied, left a lasting impression on his mind of their valuable properties.

This impression was not generally shared by those engaged in electrical work at the time. Indeed, there was a prevalent prejudice in America against the storage battery, but this was generally most pronounced in those who knew the least about their behavior from actual observation. This prevailing antipathy, which found expression in loud denunciation and severe condemnation of the apparatus, could be traced to failures in their use which were mostly due to two general causes, namely, the employment of the batteries in services for which they were unfitted, and the weak mechanical construction of the cells first put on the market.

Nothing, perhaps, contributed so much to their bad reputation as the failures which followed their adaptation to city traction systems in the storage battery car. This service had been found too severe for the batteries as they were then made, just as the first electric motors employed in street railway work were found to be inadequate for good and reliable service. The batteries lacked mechanical strength, the forming processes were imperfect, proper adhesion of the active material to the supporting plates or grids was not secured, the importance of using a pure electrolyte was not well understood, and the results were unsatisfactory operation, rapid deterioration, and loss of capacity.

So-called new types were constantly being evolved. Many and ingenious were the means employed to overcome the defects which had developed in practice. In reality all these devices were mere modifications in the design, mechanical construction, or manner of forming of two fundamental types, the "Planté" electrolytic cell and the "Faure" pasted cell, named after their inventors.

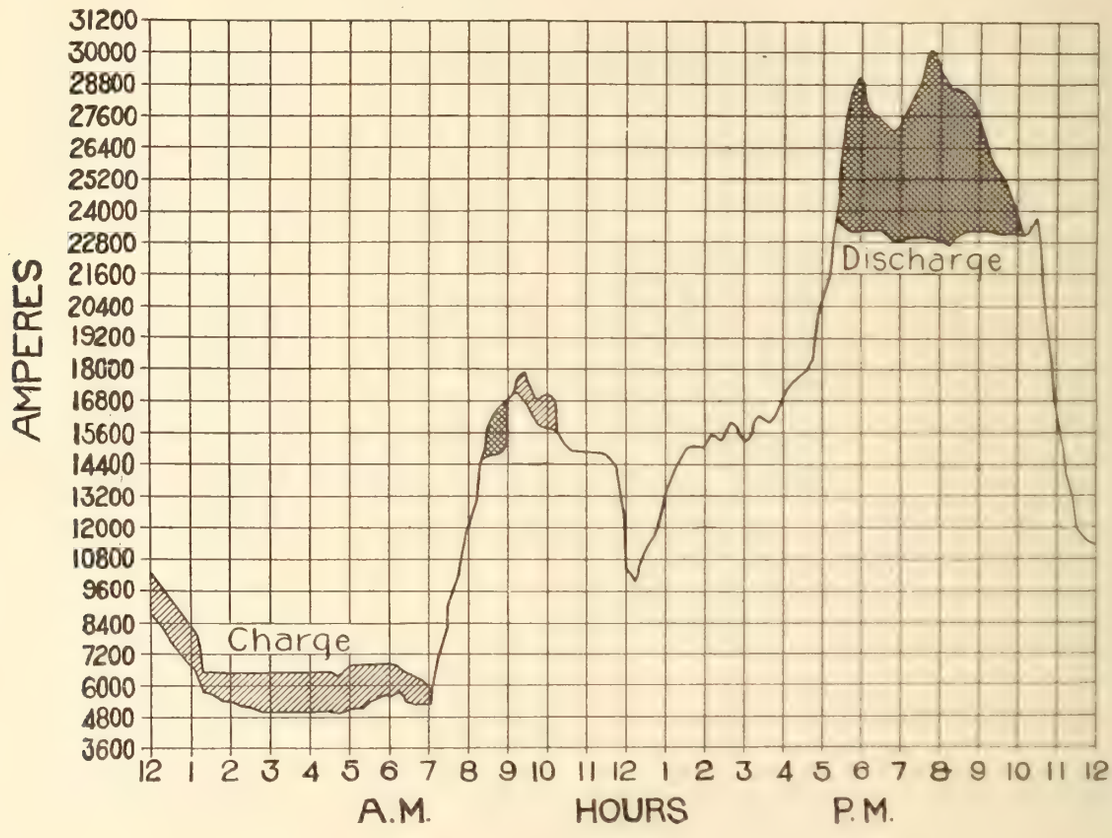
The work of Gaston Planté, which resulted in the secondary or storage battery, stands out in the history of electrical development as a shining example of exhaustive investigation. So thoroughly did he treat the subject of secondary generation of electric currents by means of the lead accumulator, that little was left for others to do in that line of work but to invent variations on the originals which he had established.

Later, other types were brought out, in which other substances than lead were used for plates, and electrolytes of various kinds were employed, but it is not within the scope of this paper to enter more fully into their description.

Then there came a consolidation in America of the various storage battery interests, and this led to a process of selection and elimination, from which was evolved a stronger and better battery than had been made before. A cell in which everything had not been sacrificed to weight, but one capable of meeting fully the requirements of commercial usage in those fields of application for which experience has shown the storage battery to be fitted. Then the range of application was narrowed, and the battery was not allowed to be sold for uses where failure might be expected, and thus was the previously unenviable reputation of the storage battery largely redeemed.

So many successful applications have since been made that the electrical engineer cannot now afford to ignore the storage battery as a factor in the design of electrical plants for railway, light or power supply.

It has been the general practice in designing electric light and power stations and in selecting the equipment most suitable for the work to be performed, to consider every type of generating apparatus and auxiliary devices, except the storage battery. When it was introduced it was generally an afterthought, or a means of overcoming a difficulty which had developed in the operation of a plant. As the storage battery factor has in many cases a distinct bearing on the capacity of the generating plant, much outlay and expense would often have been saved by providing for the battery in the first place as an integral part of the installation.



Curve 1.

The writer does not claim that it is advisable to use batteries in all kinds of electric plants, or in any kind of plant, under all conditions, but the motive of this paper is to enter a plea for the due consideration of the storage battery as a possible factor influencing the design of electrical installations, with a view to their efficient, economical and uninterrupted operation.

One of the most serious drawbacks in the operation of electric supply stations is the inability to store the product, so that generating machinery must be installed of capacity sufficient to meet the largest demand, even if such demand only lasts a few hours, and is only made once a year.

One of the things most sought in operation is close voltage regulation, regardless of the amount and character of the load.

The storage battery provides the only known means of reducing the generating plant and ensuring its operation under best conditions for economy by taking energy therefrom during the hours of light load and returning it to the circuit whenever the demand upon the station exceeds the capacity of the generators.

The storage battery ensures close regulation of voltage at the station by keeping an even load on the generators and prime movers (whether engines or water wheels), thus maintaining generator losses constant and preventing fluctuations of speed. The voltage may also be maintained

constant at the point of distribution by placing a battery there.

The storage battery also ensures uninterrupted service, as it permits of shutting down one or more units, either to make repairs or for economy in operation.

These advantages, which may be obtained by the judicious use of storage batteries, must appeal to all, but one must closely observe the behavior of batteries in practical operation to fully appreciate their value. Hence the writer would urge those who have not already done so, to visit and study some of the battery installations, of which many may be found in the United States, and a few in Canada, in operation under various conditions.

Storage batteries cannot be charged by alternating currents, therefore their use is confined to installations where direct current is available, but not necessarily only to plants generating or distributing direct currents exclusively. Thus, batteries may be used in connection with the following systems:

1. Direct current generation and distribution for light and power services.
2. Direct current generation and distribution for railway service.
3. Alternating current generation and transmission, and direct current distribution for railway service.
4. Alternating current generation and transmission, and direct current distribution for light and power services.
5. Alternating current generation and distribution for light and power services.

These systems can, of course, be mixed. There are plants in which two or more systems are combined.

Considering the application of batteries to each in turn, the mixing or combining of systems will not of course interfere with the usefulness of the batteries.

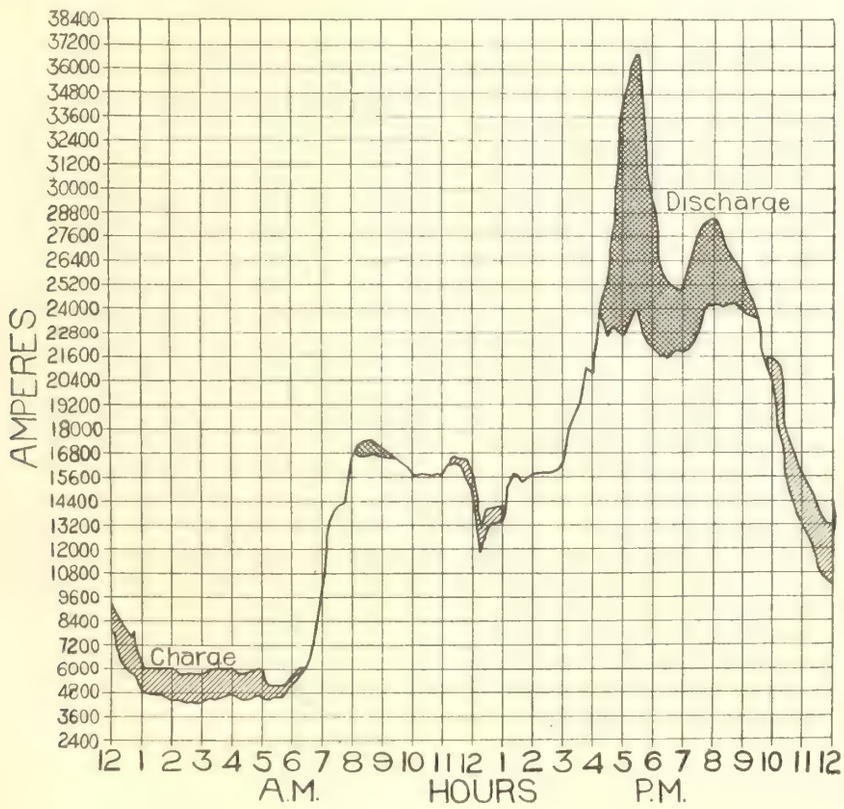
1. Direct Current Generation and Distribution for Light and Power Services.—Upon a system of this kind a battery can be installed at the power house where the current is distributed by the two or three wire method, or it can be located at a point out on the line near the centre of distribution. In many cases batteries are used at both places upon the same system.

The two curves which are marked 1 and 2, show the result of the operation upon a large station. On curve No. 1 the peak of the load is quite long, lasting for practically four hours. This peak rises to a maximum of 30,000 amperes, and of this amount the battery carries about 7,000 amperes, and the machinery is kept running from 5.30 p.m. until 11 o'clock p.m., at practically a constant load amounting to 23,000 amperes. The battery in this case receives its charge during the morning hours, from 12 o'clock midnight until 7 a.m. At this time the actual lighting load is not much more than 5,000 amperes. Curve 2 is of similar nature, except that the peak is somewhat different. There are in reality two peaks, one occurring at 5 o'clock, and one at 8 o'clock, separated by an interval of two hours. In this case the maximum rises to 36,000 amperes, and the battery absorbs the double peak, enabling the generator to run at practically the same load as shown on curve No. 1.

The point brought to one's mind by these two curves is the fact that although the nature of the load may vary from day to day, the actual load falling upon the generator may be adjusted, so that it is practically the same each day, the battery taking the irregularities. This is of manifest importance, not only from a standpoint of efficiency, but of satisfactory and simple operation.

Curve 3 shows the effect of a battery operating at a sub-station. This curve shows the current absorbed and given out by the battery for twenty-four hours. The variations in this curve follow the changes in load at this point. Between 4 and 6 p.m. the battery is called upon for a maximum current of 30,000 amperes. There are also other short times in the day, one between 7 and 8 in the morning, one beween 1 and 2 in the afternoon, and one between 8 and 9 at night, during which the battery discharges.

The result of such operation is not only to relieve the main station, but also to reduce the copper investment or copper loss, and the removal of the fluctuations of voltage due to the varying drop in the conductors, caused by fluctuating loads.



Curve 3.

In most of the large Edison systems in the United States now using batteries, the cells are arranged with several end cell switches, which enable feeders to be tapped in at various points upon the battery, thus obtaining feeders of varying pressures. This is of great importance in handling distribution over wide areas. Upon very large systems, such as are represented by the curves shown, the load during light hours is of such magnitude that it is not practicable to shut down the generating stations, and in such cases the batteries are very seldom used for this load. Upon smaller systems, however, this feature is of great importance, and it is usual to shut down the station say from 11 or 12 o'clock at night until the following morning. In one small plant not only was the battery utilized in this way from midnight until morning, but during this time the plant was locked up, and the battery carried the load without attendance.

When a battery is installed at the power house, it is not necessary to adopt the old system of using two generators in series for the three-wire system, since the neutral can be taken to the middle part of the battery and the battery used to take the unbalanced portion of the load.

2. Direct Current Generation and Distribution for Railway Service.—It is evident that the same advantages which obtain from the use of batteries in general light and power service will apply here. The charge and discharge

curve, however, will be very different, as the peaks of the railway load will occur every few seconds. The generators may be made to carry all day substantially an even load, much under the maximum demand, and the regulation will be wonderfully improved, especially if batteries are placed at one or more points on the line.

3. Alternating Current Generation and Transmission and Direct Current Distribution for Railway Service.—In such systems (whether combined with D.C. lighting or not) the alternating current is usually received from a distance and distributed from rotary sub-stations. From the D.C. end of the rotary the distribution is similar to the cases cited above. It therefore follows that batteries fulfil the same general requirements as before, and the battery may be installed in the rotary sub-station in parallel with the direct current end of the rotary, or it may be placed out upon the line. The advantages arising from such installations are the same as discussed above. In this case it has the additional advantage of reducing the number and size of the rotaries, and as an emergency reserve the battery has still greater advantages on account of the added risk of breakdown on the A.C. transmission lines. In most cases the energy is derived from water power, and the battery not only takes care of the fluctuations in the load, but also of the variations in the A.C. power available.

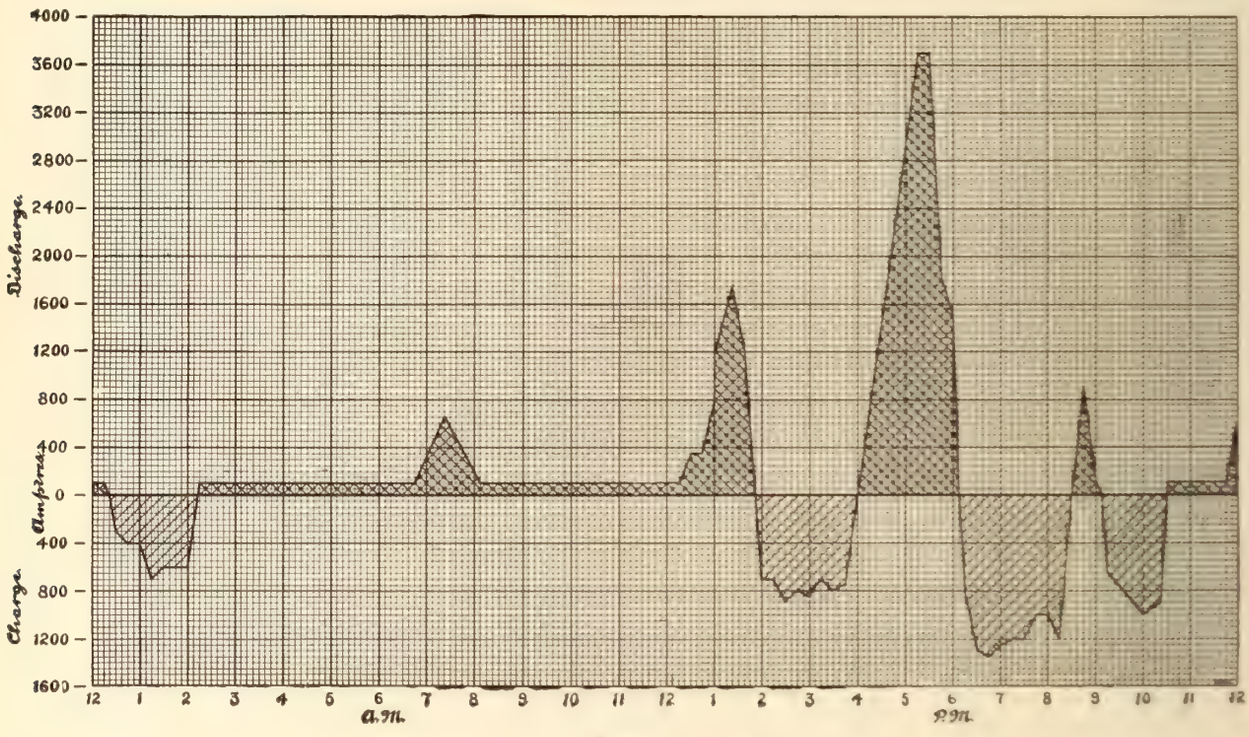
4. Alternating Current Generation and Transmission and Direct Current Distribution for Light and Power Services.—The behavior and advantages of the battery in such cases are fully described under the preceding headings. If you will imagine that the loads represented by curves No. 1 and 2, instead of being taken from central stations, were taken from the D.C. end of rotary sub-stations, these would then represent very nicely the effect of batteries operating in rotary sub-stations supplying light, or light and power.

5. Alternating Current Generation and Distribution for Light and Power Services.—Since the storage battery is of necessity a direct current appliance, it is, of course, impossible to install it directly in parallel with alternating current machinery, and where the entire system, both of generation and distribution, is of this character, it is necessary to install in connection with the battery a motor-generator or rotary, charging the battery and discharging it through the direct current end. On charge the alternating current end of the rotary will act as a motor, and on discharge, it will act as a generator in parallel with the alternating current system. The battery and rotary can be placed in the main station or at points out on the line near centres of distribution. The objection to this method is that the rotary must be of very large size, that is, it must carry the entire ouput of the battery when it is discharging at its maximum rate.

The writer does not know of any place where such a system was ever installed for the above purpose, but rotaries with batteries in parallel used for D.C. distribution have been employed in certain emergencies to assist in carrying the A.C. load.

But we have not considered the case of stations which generate alternating currents only, or sub-stations receiving alternating currents only, from a distance, which distribute alternating currents for light and power, but where it is found necessary to operate rotaries for railway service, elevator power service, or to supply D.C. motors installed under a D.C. generating plant, which has been displaced by A.C. apparatus. In any of these three cases the fluctuations of D.C. load must not be allowed to impair the voltage regulation on, say, the A.C. lighting feeders. The storage battery if placed in parallel with the D.C. end of the rotaries may be made to absorb the fluctuations of load, and enable the rotaries to run steadily under practically constant load, thus improving the regulation on both the D.C. and A.C. systems of distribution. At certain seasons the peak of the A.C. lighting load may come at a time when the D.C. load is light; in such a case the battery would be made to run the rotary as a D.C. motor, causing it to generate A.C. currents in parallel with the A.C. generators, relieving these of part of the station load.

Curves 4a and 4b, taken from a plant in this country such as has just been described, show the improvement in the voltage regulation on the A.C. incandescent lighting circuits, following the installation of a storage battery in parallel with the D.C. end of a rotary carrying a street railway load, said rotary being supplied with alternating currents from the same busses as the in



Curve 3.

candescent lighting circuits. The E.M.F., which previously varied 10 to 15 volts, now varies only 2 to 3 volts. Had a battery not been installed in this case, power for operating the railway would have had to be obtained from some other source, or a separate transmission line would have had to be built from the power house.

Some three years ago the writer installed a battery in Ottawa in multiple with D.C. generators, operating at 250 and 500 volts, on a three-wire system. The battery was placed at the centre of distribution about one and a half miles from the station. Owing to bad speed regulation of water wheels and a varying load of D.C. motors, including many direct connected elevators, it had been found impossible to obtain regulation which would be satisfactory to many of our customers. Complaints were both loud and deep for a time, until the battery was put in service. Although this battery was operated wihout booster or regulating device of any kind, the improvement in regulation was such as to silence all complaints and to elicit complimentary remarks from many of our customers.

The writer has endeavored to set forth briefly and in a very general manner the principal advantages to be derived by using storage batteries in various kinds of installations.

Two more points might be considered with special reference to the driving end of the plants, in one case a water power, in the other a steam power station.

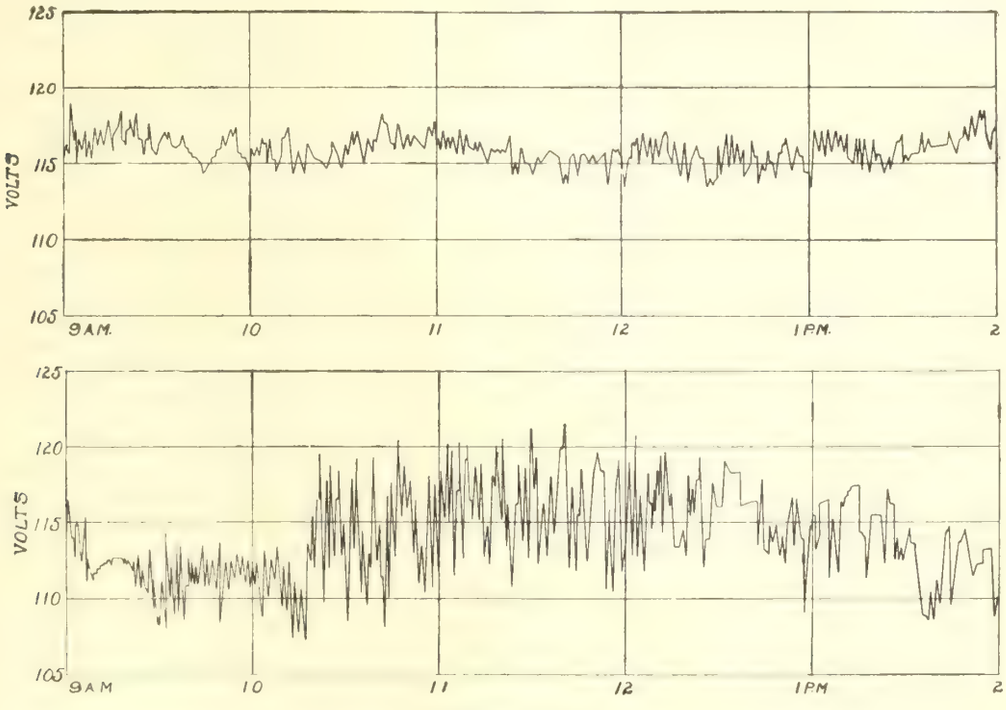
It is often the case in water power plants that power is rented at so much a year. When this power is used for lighting or railway work, in which there are heavy peaks

of short duration, it is evident that the yearly rental will be the price of the power necessary to take the highest peak of the load. In these cases a battery is used to cut off this peak, thereby lowering the rental of the water power. The size of the battery will depend upon the interest and depreciation on the battery investment compared to the cost of rental per K.W., together with the interest and depreciation on the cost of the generating capacity that the battery displaces. In the same manner, when a railway load is of a very fluctuating nature, the cost of average power will increase on account of the fact that although the average of the fluctuations is the same as the average load when there are no fluctuations, the rotary machinery works at a very low efficiency on a low load factor, and in that manner the average power required increases.

In steam driven apparatus, to bring out more fully the advantages of a battery displacing apparatus on a peak, let us imagine we have a two-hour peak; it means that the machinery to run this peak will only be operating 730 hours during the year, and will have to earn during these hours the interest and depreciation on the investment, together with the cost of operation. This is clearly impossible, and besides the benefits, accruing from the use of a battery, of improved load factor and better regulation, the saving in first cost of this apparatus must be taken into account.

The rather high first cost of storage batteries makes the question of their profitable employment sometimes difficult to solve in their favor, but as illustrated in the cases just cited, it is a matter of calculation, not a difficult problem, if you know the cost of producing power, also the rate of depreciation on the batteries and cost of maintenance, which together should not exceed ten per cent. per year.

It is not the purpose of the writer to enter into any calculation at this time, nor to advise the use of batteries indiscriminately, but merely, as stated before, to urge the members of this Association to fully inform themselves as to storage batteries, consider well their advantages, and reckon with them when designing new plants or additions to old ones.



CURVES 4a AND 4b.

THE ELECTRICAL EQUIPMENT OF AN ORDINARY STREET CAR.

By A. B. LAMBE, Jr.

Electric railways, as we are all aware, are fast becoming more numerous throughout the world. Perhaps England is making the greatest strides to-day, though still far behind this continent in the number and value of the roads in operation; this progress being such that from the double reduction rheostatically controlled 5 to 6 ton car which was the very latest and best product of but a few years back, we have come to now consider a 125 ton train, the units weighing 25 to 35 tons each, with some one of the various forms of master control now on the market, or a single locomotive, such as those of the Baltimore and Ohio Railroad—not an uncommon sight. Equally to be admired are the many forms of smaller equipments which are used to-day in large numbers, such as the various industrial railways in service the country over, for mining, telpherage, factory transportation, private shunting, in fact there to-day remains practically no form of travelling or conveying mechanism or apparatus which does not find its most advanced exponents using electricity to a very great extent, in some cases almost exclusively. By this we do not mean to say that electrical machinery is going to supersede all other forms of power transforming apparatus, or that it is the panacea for every difficulty, for we are all ready to acknowledge that compressed air, rope, belt and chain driving, and the steam engine have each their field which cannot be commercially invaded by the electric motor, but, on the other hand, electrical machinery has made fields for itself, and in doing so has been a factor in the world's increase of wealth to an extent which a few years ago was not dreamed of. Chief among these is the work of traction in its many and varied forms, and presumably it is to heavy electric railroading that we must look for the greatest field of the large output of the future, which we all trust will be a feature of the years to come.

A text such as this would occupy us for a long time, if discussed only in its generalities, and therefore we must confine ourselves to the subject matter proper, and as all that is to be laid before you will be of a strictly elementary character, it has been decided to illustrate it with samples of the various apparatus which go to make up the motive and controlling power of the ordinary car with which we are all so familiar, even if only through the fare-box; presumably the logical way of handling the matter will be to divide the equipment into its main features, and discuss them one by one, the trolley, controller, rheostats, motors, etc.

The first roads put into service used two trolley wires and two trolleys on the car, or, as it is now called, were of the double trolley type; we can all picture the difficulties encountered in such a form of construction as this where there were turnouts, crossovers and crossings to insulate; it has to-day been almost universally abandoned, the rail being used as a conductor instead of one of the wires, though occasional survivors are found. The trolley wire was round, and though soft at first was soon made somewhat harder than that used for ordinary purposes, being suspended in nearly all cases by mechanical clips, which had the great disadvantage of being in the way of the trolley wheel; the result was a heavy blow every time the wheel went under the clip. Efforts to overcome this difficulty led to the various designs of the soldered ear, the wrought sheet hanger, the Walker clip, and the figure 8 wire, an ever-improving chain leading finally to the evolution of the grooved wire, which is to-day considered the best trolley wire equipment to be found in the market. In passing we should note that a wire of any given size has the same resistance, weight, etc., length for length, irrespective of whether it is round, figure 8, or grooved.

The soldered ear in connection with a round wire is also used extensively, but its grip is not as good as that of the

mechanical clips which are used with the grooved type, and it is much more expensive to put on or take off.

The almost universal trolley wheel of this country for city work at moderate speeds, 4 to 5 inches in diameter, has reached a point where it might be considered standard. It is usually made of brass, though occasionally with iron with a brass center, to avoid undue wearing of the wire. It has a separate piece bushing, which can be renewed cheaply, a steel spindle automatically lubricated by oil or graphite, and is carried by a malleable iron harp, designed to as much as possible prevent catching in the overhead work. There are of course numerous styles and sizes of what might be termed freak wheels running up to as much as 10 inches in diameter, for high speed duty 6 inches is a common size. There is also the sleet cutter, used in localities troubled with storms in cold weather to clear the trolley wire of the accumulated ice and snow.

Under the heading of trolleys, we should mention—we have not time to go into them in detail—such other current collecting devices as the third rail, the conduit systems, and, as a curiosity, the roller trolley. This latter is used quite extensively to-day on the Continent, though it has never made any great progress in this country; it was exploited to a certain extent by the old Walker Company. The pressure of the wheel against the trolley wire is somewhere about 20 to 40 pounds, which, after the addition of the pressure or strain necessary to balance the weight of the wheel harp and pole, means a tremendous strain on the trolley stand and the superstructure of the car; few realize how large it is. When horse cars were first changed over to electric propulsion, this great roof strain was not recognized, and the cars soon presented badly distorted roofs; modern practice provides a long and heavy wooden trolley stand on which is mounted the metal base, thus distributing the stresses uniformly over the roof. The trolley poles to-day are all steel, usually seamless and graduated in thickness and diameter from top to bottom, sometimes reinforced near the stand; the first equipment was wood, with a wire run down the side to carry the current. The latest types of stand being brought out to-day are low, provided with ball bearings, and arranged so that the pressure on the trolley wire is approximately uniform, no matter what the height of the pole; it will be readily recognized that this latter feature is a valuable improvement. The latest addition to the standard car equipment is the trolley catcher, of which there are two broad types, those which prevent the wheel, when it comes off the wire, going more than 6 or 8 inches above it, and the style which not only does this but in addition immediately pulls it some 15 or 18 inches below, rendering its catching in the overhead structure a remote possibility.

The next device through which the current passes is the protector or fuse, provided for two purposes, first, to protect the system against any fault in the car equipment, which would otherwise amount to a short circuit, shutting down the complete road, or at any rate part of it, and secondly, to protect the motors from too much current, whether caused by too many passengers or too many trailers, or, as is much more frequent, by improper handling of the controller. The original equipment was a plain ordinary fuse box usually placed under the platform, but since the replacing of a fuse was a dirty and tedious proceeding, there was introduced the double throw fuse box mounted in the hood. If one fuse blew there was another already in place to which to turn; all that was necessary was to throw the handle over. Contemporaneous with this was the magnetic blowout fuse box, with which we are all familiar. All the foregoing were first-class in their day, but have been gradually superseded by the circuit breaker, which stands to-day as the standard car fusing or safety device of modern practice.

If the car is provided with an ammeter it is usual to insert it next in the circuit. Such an instrument is a somewhat unusual equipment except on the heavier cars used for high speed work.

The current goes now to the controller, the case placed on the car platform, and which, actuated by the motorman, makes the car go fast, or slow, or stop, according to the position in which the handle is placed. Just as the ordinary constant speed stationary motor is started to-day by the insertion of resistance in series with its armature, so the first railway motors were controlled in a similar manner, the Thomson-Houston type with the operating handles on the platform controlling through wire cables a semi-circular rheostat, placed under the car; the equipment being sometimes known as the "stemwinder" is perhaps the most widely known of this type. Recognizing the wastefulness of this method, especially where a motor, as is the case in railway work, has to be run so much of its time at less than full speed, there was brought out the Edison drum controller, which was more economical in that it altered the speed partly by the use of a rheostat, and partly by varying the field strength by connecting the coils composing the field, of which there were several, into various combinations of series and multiple. This was a great improvement in another direction also, as it brought the working parts up on the platform where they could be easily inspected, the Westinghouse Company bringing out a somewhat similar type, in which the growing duty imposed upon street railway apparatus was recognized by making the working parts heavier and more substantial. After these came the type which, in combination with a rheostat, put the motors in series or in multiple, as desired, whence the name series-parallel, this idea being the principle underlying all the various types of present day apparatus, the economy in power consumption over a pure rheostatic control being so marked that nobody to-day would entertain the latter for a minute; the main principles governing its operation can be outlined as follows:

The variable speeds necessary during the day's operation of a car can be obtained, assuming that the load is kept constant, only by varying the voltage impressed upon the motors. This variable voltage can be produced either by inserting resistance in series with the two motors connected in parallel, or by connecting the two motors themselves in series, in the latter case one can be said to act as a resistance for the other, each running at approximately half speed and producing a counter E.M.F. of 250 volts, the two added together balancing the impressed or line voltage of 500. When connected in this way the current goes through one motor and then, instead of through a wasteful resistance (in which case you would need another current of equal amount to operate the other motor), the same current goes on through the second motor and in so doing produces useful motion. The result of this is that with the motors in series the current and consequently the power consumption is just half what it would be if the same reduced speed were obtained by means of resistance. Further, if the voltage delivered to each motor be changed abruptly from 0 to 250, and from there to 500, without any intermediate graduations, the speed of the car would be correspondingly jerky, and so it is found necessary to insert rheostats, but for a short time only, in circuit with the machines, both when first put into series and also when first thrown into parallel; these, however, are almost immediately cut out, in 3 or 4 steps, and thus a gradual acceleration is obtained. We thus see that the series-parallel controller, of whatever type, is a piece of apparatus, a combination of switches, which are arranged so that the rotation of the drum first connects the two motors in series with each other and a rheostat, by further rotation of the cylinder this latter being gradually cut out until the motors only are left; next they are connected in parallel with each other, the rheostats being again inserted to prevent the sudden rush of current and the corresponding increase of speed which would otherwise result; again the rheostats are cut out, leaving the motors alone but now in parallel. The first step of the controller gives the slowest car speed available, the current consumption of the car being the same as that in each of the motors, seeing that the same current goes first through one and then through the other; the last step of the controller gives the highest speed, the car now consuming twice the current in each motor, seeing that two entirely separate and approximately equal currents are passing through each machine.

This type of apparatus, irrespective of the manufacturer whose name it bears, presents the same general features. The reversing switches, one for each motor, are contained in the same case as the main cylinder (in the first equipments they were separate, being mounted under the platform), and are mechanically interlocked with the main cylinder, so that they cannot be operated unless the latter is in the off position, nor in turn can this be moved if the reverse cylinder be in its center or off position. The first interlock is provided for two reasons, namely, that it is highly undesirable, both on account of its effects on the motors and on the line, that a man should have the power to suddenly reverse a car without having to first throw off the current, and again, the reversing switch being built with but small clearances between the various parts and practically no arc disrupting power, if opened with current on would probably be destroyed by the resultant arc. The second interlock provides a quick means of noting the position of the main cylinder, and also of insuring that, in the absence of the reversing handle, the car cannot be moved either accidentally or by interference. Switches are provided for cutting out each motor, obviously a great improvement over the original method of disconnecting the car wiring, at the point where it entered the motor, by means of a screwdriver. When the controller is built so that these switches replace the machine which has been cut out, by closing the circuit, they also interlock with the main cylinder, so as to prevent the latter going beyond the series

steps, when they simply cut out the operating machine and leave open the circuit in which it was formerly connected; no interlock exists and the car takes no current, and consequently does not move until the main cylinder is turned to the parallel steps. The remaining feature worthy of note is the arc disrupting device which is provided on the main cylinder of practically all series-parallel equipments, the magnetic blowout. It will readily be recognized that the work of a controller, especially on a city road where it is in almost constant use, is something tremendous, and that the effect of the arcs, if not broken as quickly as they are by this device, would lessen the life of the wearing parts in a very marked degree, or conversely, to get the same life you would have to build a much larger and therefore much more costly piece of apparatus. In fact the present spacing of the fingers, without the blowout feature, would not break the arc at all, and almost every time you turned the cylinder off, if carrying a current approaching the full load of the motors, you would get a short circuit.

Controllers are built to handle both two and four motor equipments; the two types do not differ to any great extent, it being usual, in four motor cars, to connect two machines permanently together, usually in parallel, and consider them as one machine; the other being treated similarly, the controller taking these two groups as if they were two motors only, instead of two units each consisting of two motors, and putting them in series or in parallel as desired. The main difference between a two and a four motor controller, apart from the fact that the latter is larger and heavier in its conducting parts, is in the reversing switch, which has two sets of fingers for two motors, and four for four motors. It is essential that there be a complete reversing switch for each and every motor on the car; if not, the result will be extremely unequal field strengths, or, in other words, the work of driving the car, instead of being performed by each motor doing its own share, is left nearly all to one.

Tests have shown motor currents of 60—30, 80—20, 90—10, 125—15 amperes respectively on the machines of a two motor equipment, and on four motors 90—40—20—5. The same car when equipped with a proper four motor controller, the motors, rheostats, loads, etc., being unchanged, gave readings of identically the same value on all motors, namely, 20 amperes.

The weakened field system of speed control, obtained either by cutting out some turns of the field wire, or by shunting part of the field current through a resistance, used originally with the Thomson-Houston rheostatic system, was continued when the series-parallel equipment was first introduced, but has been discarded by later practice. It was found to be more or less of a complication, especially when used in connection with multipolar machines, whose use was not warranted by the results obtained.

Roads operating high speed four motor equipments frequently find it necessary, or at any rate desirable, to be able to reduce the maximum possible speed of their equipments without being compelled to keep the rheostats constantly in circuit, examples being cases where municipal ordinances require slow speeds within their limits, or where exigencies of the service demand that equipments normally arranged for high speeds be available for shunting. This condition is conveniently met by the addition to the standard controller equipment of what is called a commutating switch, a piece of apparatus which, distinct from the controller which it accompanies, performs the function of connecting the two motors composing each group in series for slow speeds, shunting, or heavy haulage, in parallel for normal operation at high speeds. With this switch set in the series position, all four machines will be in series on the series steps of the main cylinder (A), when the latter is turned to the parallel position two motors in series are put in parallel with two in series (B), with the commutating switch set for parallel connection the combinations become respectively two in parallel in series with two in parallel (C), and all four in parallel (D). Assuming the line voltage and car weight to be unchanged, A gives the least power consumption and the slowest speed, D requires most current and produces the highest speed, B and C are identical in their results. An exception to the foregoing might be noted in those cases where locomotives, normally designed for large tractive power at slow speeds, are sometimes required to develop higher speeds when running light, in which event the series connection is the normal position of the commutating switch, it being turned to parallel only when the more or less infrequent call comes for high speed. This switch not being intended for operation when the car is in operation, is not provided with any provision for extinguishing the arc; if opened with current on the motors it would probably be destroyed.

There are several interesting peculiarities in connection with the series-parallel method of control, the reasons for which are not always apparent. One is that of wheel slipping, which is especially troublesome with single truck cars. If one of a pair of wheels start to slip, the motor in series, it will be seen that it is almost impossible to get reasonable traction from the car as long as the motors remain connected in this manner, because that motor which is running comparatively fast, due to its consequent high counter E.M.F., takes but little current. This in turn means that the other machine, being actuated by the same current, has but a small torque due to the little current flowing, and the grip of the slipping wheels being practically nil, the total tractive power of the car is but small. On the other hand, if the motors were in parallel, the one not slipping, due to its slow speed and consequent low counter E.M.F., would take a large current and therefore have that much more tractive power. Wheel slippage is much more common on single than on double truck cars, because in the former it is comparatively easy to unbalance the distribution of weight, in the latter the relative length of the car past the trucks, or the overhang, as it is called, is much less, and consequently the position of the passengers has less influence. On the other hand, a single truck car, with the modern long rear platform, is frequently loaded down so as to take quite a large amount of weight off the front wheels; again, at starting, which is the time slipping is felt, the truck tends to go forward and the body to stay behind, the result is a tilting action also tending to decrease the weight on the front wheels. For this reason, and also because dirt or snow is encountered first by the front wheels and the rail more or less cleaned by them before the rear pair pass, single truck cars, when on straight track, usually slip most in the front wheels. On the other hand, when on curves the front flanges grip on the sides of the rail head, and also on the lip if a grooved section be used, the trailing pair riding comparatively free, so that the condition is reversed, the rear wheels being more likely to slip.

Another peculiar point is that, under a certain condition of trouble with the wiring or controller, a car which normally gathers speed with each successive step of the controller, runs faster on some of the series or lower speed steps than on the first one or two of the parallel positions, this condition being that of a ground on the wiring of No. 1 motor between the point of its leaving the machine and entering the controller, and which, until the motors are not in series, virtually short circuits machine No. 2; consequently the latter is not in circuit until the controller is turned to the parallel position.

The foregoing applies to individual controllers, one or two per car, manually operated, the multiple unit or master control system involves various special features; it is not possible in the scope of this paper to do more than enumerate the bread principle, which is as follows:

Each car equipped for master control has mounted upon it its own motors, two or four in number, a main controller to handle them, a set of bus wires, extending from end to end of the car and connectable to those of the next car, for moving this controller, and one or two master controllers for energizing these bus wires. From the foregoing it follows that when the bus wires of two or more coupled cars are connected they can be energized throughout the whole length of the train, from any one master controller desired. When this is done, current having been turned on to these bus wires from some one of the master controllers, all the various main controllers move, and obviously simultaneously, assuming different positions according to which of these bus wires be energized, and in doing so they in turn connect the motors into series or parallel, similarly to the hand-operated apparatus. It will thus be seen that any number of motors, mounted on various cars, can be simultaneously varied in speed by the operation of any one small master controller.

There are three systems now on the market, the Sprague, Westinghouse, and General Electric. The Sprague Company use a main controller, modelled somewhat after those built for hand operation, replacing the motorman's handle by a small motor. The Westinghouse Company use an air cylinder, with a pinion and rack, in place of this small motor, controlling the admission of air to the cylinder, and thus the movement of the piston, by electrically operated valves. The General Electric Company divide the main controller into a number of separate switches, consisting of a movable arm, on the end of which is mounted a contact, this arm being actuated by a solenoid supplied with current from the bus wires.

The question of brakes does not properly enter into the electric equipment of a car, except those which are electrically operated, though it is interesting to note the various styles and classes which have become more or less standard. There are in use to-day three main types, the manual, mechanical, and electrical. The greater part of the equipments in ordinary city work belong to the first division, being

equipped with spring or gravity release, and occasionally being reinforced with the safety device of a plunger arranged to act as a block behind the rear wheels, used only on systems running over numerous heavy grades on which stops have to be made. In the mechanical class are grouped those types whose breaking mechanisms are actuated by the motion or momentum of the car through the medium of a clutch mounted on one of the axles. The air system would also come under this head; there are two distinct methods, one in which the car reservoirs, comparatively small, are charged from a motor and pump carried on the car itself, and the storage system, in which the cars are replenished from a common pump situated at some convenient point on the line, in which event the car storage tank is relatively larger. The electric types operate either by friction discs, one revolving with the axle and the other mounted on the motor, or by a solenoid pulling a plunger on to the rail head and at the same time, through a suitable system of cams and levers, setting the shoes on the wheels in the ordinary manner. In both types the current, which is obtained by operating the motors as generators, is controlled by the main cylinder, which is then provided with additional steps and turns backward from the off position. There is also the emergency electric brake, which, while not commercial, may occasionally be of great service, it will be discussed later.

The lighting of practically all our modern cars is by means of incandescent lamps, and presents no special features; they should in all cases be equipped with reflectors, whether mounted in groups or singly. Cars built lately are usually equipped with either bullseyes or illuminated signs to indicate the route to which they belong; these are furnished with light by either a series of lamps of their own, or else by some of those which also light the car.

It is now usual in the case of double-ended cars to arrange the headlight so that when one is in use the vestibule light on that platform is extinguished, and vice versa; this is accomplished ether by means of a removable headlight, in which case the action is automatic, the transferring of the lamp itself accomplishing the switching; or else if the headlights are stationary, one on each end, switches are used to light either them or the vestibule lamp as desired.

The headlight most frequentiy consists of an incandescent lamp, mounted inside a weatherproof case, which also contains a reflector, more or less efficient according to the money put into it, though very frequently, especially for interurban work, where cars are run at a fairly high speed and therefore require a somewhat greater length of road in which to stop, arc lamps are used for this purpose. Being on a 500 volt circuit, they require a rheostat in series, sometimes the incandescents in the inside of the car are used for this purpose, though it is more usual to employ a dead resistance. In the more temperate climates this is occasionally used as part of the car heating system, being mounted under the seats and arranged with radiating facilities, so that the hot air coming from them assists in warming the car. Occasionally the cars are equipped with arc lamps for inside lighting as well as for the headlight, in which case they are all run in series.

On those systems which require artificial heating of the cars, the method by which it is to be accomplished is a very moot point, coal, hot water and electric all being available, the advantages, from the passenger's point of view, being all with the latter; there is also much to be said in its favor from the operator's standpoint. In the first place it is absolutely clean as compared with any form of stove, there being no ash to cause dust, nor fuel of any sort to carry along with the car; if properly built they present no source of fire risk; they give off no noxious fumes, ready for instant service they do not occupy the conductor's attention which might profitably be employed elsewhere, and if properly arranged they distribute the heat all along the car in the place where it is most needed, namely, near the floor. On the other hand, any form of coal stove placed in the car body is notoriously deficient on all of the above points, scratching the frame when being taken in and out, a source of dust and dirt, it is unanimously voted a nuisance by everybody; the only thing to be said in favor of any of the various forms of heating, opposed to electric, is that they are cheaper. Roughly speaking, it costs something like seven times as much to heat a car electrically as it does by coal, or to put the matter in another way, seeing that the average horse power consumption of an ordinary city car will be somewhere in the neighborhood of 20 h.p. per hour, and that of the heaters 5 to 10, it will at once be recognized that if the cars are to be heated electrically that the generating equipment, with the engines and boilers or water wheels to operate it, must be materially increased over that necessary for the work of propelling alone. It is usual in electric heating to provide means for varying the temperature and correspondingly the current consumed, by dividing the heaters into sections and connecting these in various combinations of series or parallel.

The rheostats of modern equipments are usually built of some form of iron resistance, coiled iron wire, iron ribbon, or cast iron girds, the latter being the latest form. They are required to dissipate considerable energy in the form of heat, and therefore have to be kept more or less away from the car body, usually bing mounted on insulated supports to the under side of the framework where they can be got at for inspection, and still not be in the way of water and dirt from the wheels and street.

The usual equipment is not designed to remain in circuit for any appreciable period longer than that necessary to start the car, which is the reason for marking only certain of the controller steps as running positions; if the cylinder be left too long on those which have the whole or part of the rheostats in circuit, they are likely to be damaged. Commercial requirements, which are the limiting features of all apparatus, seldom call for continuous running on any of the rheostatic steps; if desired it is only a matter of money to put in sufficient capacity to be able to do so. In locomotive work, where shunting at slow speeds is a necessity, the rheostats are made much larger, the equipment for a pair of motors used for this class of work being in some cases as much as four to five times as large as that necessary to control it for ordinary traction duties.

We next come to the consideration of the motors themselves, they constitute that part of the equipment in which the electrical energy, conveyed from the stationary trolley wire to the moving car by means of the trolley pole, is converted into mechanical power, the machine which forms the actual source of motion of the car. The electric motor, as we have so often been told, was more or less accidentally brought to light; it being discovered that an ordinary dynamo if supplied with current would rotate and deliver mechanical power from its shaft; similarly the first street railway motors were dynamos, arc machines it is generally reported, coupled to the axle by means of belting or chains; these were soon followed by machines designed for this particular work, the first types being bi-polar, with high speed armatures and double reduction gearing (two pinions and two gears), the electrical parts being absolutely unprotected from the weather. The motors of to-day, irrespective of their makers, all have the same general features; four poles, two sets of brushes, single reduction enclosed gears running in grease, and a practically water-tight cast steel motor case, usually parted horizontally. Between the first more or less experimental forms and the machines now standard there were a tremendous variety of ideas and forms brought out; it is impossible to go into details here, though it will be of interest to touch on the main features.

The first gears, as above, were double reduction, that is, there were two pinions driving two gears, made of rawhide, brass and steel; cast iron also was used; to-day cast steel for gears and hammered iron or steel for pinions is the usual standard. It was soon found that the open gears wore very rapidly on account of the dust and dirt which they encountered, and therefore with the introduction of the single reduction type came the gear case; this at first was of sheet copper with a cast brass frame rivetted and soldered together, passing in turn through an number of stages to cast iron, malleable iron and pressed sheet steel; experiments are now being made on a type composed of a canvas cover on a brass frame with a spring sheet steel lining on the lower half.

Both ring and drum windings have been used for the armature, made sometimes with round wires and again with those of oblong section, the coils wound on to the body by hand, or again being machine formed before winding. For the commutator cast brass and cast and wrought copper have all been tried; to-day standard construction uses machine wound coils, drum windings and wrought copper bars equipped with carbon brushes.

The first machines were bi-polar, and when it was found desirable to cut out one set of gearing there came the consequent struggle to reduce the armature speeds; the most obvious method was to increase the number of fields from two to four, and a number of forms were brought out for that purpose. The first types had two consequent and two salient poles; if arranged with the former horizontal, they made the depth of the motor too great, seeing that the standard 33 inch wheel allows but little room to keep clear of the roadbed; if placed vertically the machine could not be parted along the horizontal plane, which latter was an extremely desirable feature. Finally their came the four pole salient type arranged with the poles set 45 degrees from the vertical, which allows convenient horizontal parting and is the form which has been adopted by practically all manufacturers.

Practically nothing but cast steel, or some one of its

nearly allied compositions, has been used for the motor frame proper. The original machines were entirely open, and the first attempt at protection from water and dust was a pan placed underneath and partially up the sides of the machine; then canvas was hung down from the car body; next the frame itself was extended so as to afford more protection to the parts inside, and finally it was made in two bowl shaped halves, completely enclosing the armature and fields, which is the style standard to-day for moderate sized machines of all makers. The field poles are cast as part of the frame, or sometimes cast steel machined separately and bolted to place; again there is the laminated type, either with the frame cast round them or held in position by bolts, as compared with the solid pole this construction produces a lighter machine for a given output, and one somewhat more efficient: In this totally enclosed type of case the ventilation is practically nil; on elevated systems and in some interurban roads advantage is taken of the comparative absence of dust and dampness to put openings in the frames which, partially closed by screens, allow more or less air to circulate through the windings.

The lubrication of all moderate size motors is by means of grease, held in pockets cast in the frame over the bearings; these latter are generally outside the machine proper, being provided with channels underneath so that any overflow or drippings are thrown outside, lubricants of all descriptions being fatal to good insulation. Occasionally there is provided an auxiliary oiling wick underneath the bearing, the grease then being more or less of a reserve intended to be used only if the journal gets hot, in which event it melts and thus provides extra lubrication. On the heavier motors for elevated work, oil is depended upon almost entirely, though it has the disadvantage of causing much more drip than the greases.

The foregoing covers the general outline of the standard moderate sized street railway motor of to-day, there naturally are many modifications, such as the type in which the frame instead of being split horizontally, is cast in one piece cylindrical in form, the armature and fields being removed through openings in the ends, normally filled by cast iron shields carrying the bearings; there is also the gearless motor, a type which has found much more favor on the Continent than it has over here, though it should be noted that the Baltimore and Ohio locomotives, the largest electric traction machines ever built, weighing nearly 100 tons each, are of this type.

Equally a curiosity, at any rate on this continent, is the alternating traction motor ,though it has been used to some extent in Europe; those built over here follow to a great extent the general lines of the D.C. machines, except of course in their internal arrangements. It should be observed that they can be run in series parallel, the armature of one machine supplying the fields of the next, somewhat similarly to the standard series parallel controller.

All street railway motors to-day are series wound, that is, the same current after passing through the armature goes on through the field coils, or vice versa. Shunt machines are unsuitable for several reasons, one is that being essentially constant speed apparatus they would tend to drive the car at the same rate irrespective of the load or the grade. In climbing hills this would result in a greater current consumption than the motors could stand, on the other hand the series motor slows down with an increase in load, and consequently takes less current than would be needed if the same speed were maintained.

The field coils are sometimes connected in front of the armature, in which case they are said to act as a choking coil, and to thus lessen the chances of lightning damaging the latter; in other systems they are connected next to the ground in order to lessen the chances of trouble in themselves. If wired in this manner, when the motors are in parallel the maximum potential between the fields and ground is about 30 volts, when they are in series this is increased on No. 1 machine to 250 volts, No. 2 remaining as before.

The next point to be considered is the method of using the motors as an emegency brake. If the motors are driven by some outside force, such as momentum or gravity, they tend to generate current the same as any other dynamo, and if the connections of the field be reversed with respect to the armature, they will gradually produce more and more voltage, or build up, as it is termed. Further, if they now be connected in parallel, any slight difference in voltage between the two will start a current flowing which still further changes the field strengths and thus produces an increase in the current. This means that one machine becomes a generator with a heavy load, which tends to pull it up, this in turn through the gears tending to stop the car. The other machine becomes a motor with a heavy current forced through it and consequently a heavy torque, but being reversed instead of tending to drive the car forward, as does current from the trolley wire, this tends to drive the car backwards. It will thus be seen that the action of both machines is to stop the car, which will pull up quite sharply. Now, as soon as this has taken place the current ceases, and if the car be on a down grade it will immediately start again, and after it attains some slight speed the process will repeat itself; it is thus possible to take a car down hill without the aid of either brakes or current from the trolley wire. It should be noted that this method of stopping is quite distinct from that of using the main current with the machines reversed, further, that on a two motor controller the throwing of the reversing switch does not put the motors in parallel, they can only be connected in this way by means of the main cylinder which has to be turned to some one of the parallel positions, which is immaterial; with the current breaker open or the trolley off there is no closed circuit on any of the series steps. On the other hand, with a four motor controller, there being two pairs of machines permanently in parallel (except when equipped with a commutating switch set for series connection), all that is necessary to obtain the desired connection is to throw the reverse handle. Occasionally there are found two motors which are so nearly alike, or give results so closely allied that this action will not take place, though it is probable that 99 per cent. of the cars in service to-day will act as described above.

The foregoing covers, in outline only, the principal parts comprising the modern electric car equipment of medium capacity; it is obviously impossible, within the limits of this paper, to go to any extent into detail; there remains but to glance at its general properties compared with electrical apparatus designed for radically different service.

Compared with commercial stationary direct current machines having about the same armature speeds, we find that the street railway motor, horse power for horse power, weighs somewhat less than half as much as does the former, direct current machines of the lower speeds averaging 110 to 135 pounds per h.p.; the street railway motor somewhere about 65. You must further note that the latter machine has a momentary maximum output of two or three times its normal capacity, that is, a machine rated at 30 h.p., according to the methods adopted by standard practice to-day will for short periods give an output of 80 to 100 h.p., in fact there is to-day no other machine which, weighing but one ton and contained within the three dimensions of about 30 inches, will produce from 25 to 50 h.p. and this with a high degree of economy; obviously this result is obtained only by having a machine of the greatest simplicity composed of the very finest materials obtainable and built with the utmost attention to every detail.

Further, it is to be observed that some of the machines made for this purpose are by no means small. The first cars put into service were equipped with two motors of about 12 to 15 h.p., each weighing in the neighborhood of 2,300 pounds; to-day the ordinary car in city service has two 35 or 40 h.p. motors, weighing with the controlling mechanism about 3½ tons, the complete car averaging about 12 tons. The average car on interurban high speed service, equipped some with two motors and some with four, varying from 50 to 80 h.p. each, will weigh somewhere in the neighborhood of 25 tons, 8 to 12 tons of this being accounted for by the 200 to 300 h.p. of electrical equipment with which they are provided. Cars for elevated roads will average somewhere about 30 tons each, and as they are frequently run in trains of two and three, the complete outfit will weigh in the neighborhood of 100 tons. The Baltimore and Ohio Railway Company's locomotives are the largest electrical traction machines in use to-day; they weigh about 100 tons each, the motors, of which there are four, being rated at 325 h.p. each, the normal current input of the complete machine reaching the large total of 2,000 amperes.

It is obvious that, having such a fine equipment as the modern railway motor, we should make every effort to keep it in good shape, to get from it the maximum of service with the minimum of cost and to maintain a schedule free from the most annoying of troubles, road breakdowns, one of the most essential points to this end is a thorough system of inspection, without some such procedure it is hopeless to expect anything but that the repair accounts will be unduly large, and your customers far from satisfied with the service they receive. It is usual in modern railway practice to have two and sometimes three distinct times of inspection for each car, every road having a night man who makes a visual and more or less superficial examination each night, and a barn repair crew who dismantle and thoroughly overhaul every equipment at stated intervals of 6 to 12 or 14 weeks. To these some roads add the day inspector who visits each car when in service, examining the operation of the commutators and the controllers, and receiving reports from the crews as

to any incipient defects which they know should receive attention.

The greatest aid to such a system of inspection, and in fact a prime necessity of its existence, is a set of books, as simple as possible, but nevertheless complete in that they show the date of every operation, both day and night, on each car, and the names of the men performing them, from records such as these you will be able to determine and accurately keep track of the date on which any car is due to come in for general overhauling. Having determined, from the class of equipment and the amount of work it has to do, the safe running limits of the machines, that is, the longest time which it is practicable to leave them on the road and still not run into danger of having breakdowns, it is highly desirable to keep the system in such shape that the cars come in very close to the periods set for them. Such a system as this, apart from lessening the cost of repairs and reducing the number of street breakdowns, has great value in another direction, namely, the question of damage suits. Accidents, as we have all been told so many times, will happen; happy is the man who, in the hour of trial, can produce complete records and show that the car equipment in question was inspected and overhauled on a certain specified date by men competent and familiar with this class of work, and pronounced by them to be in thorough workmanlike condition; he has gone far towards acquitting his company of that bugbear and foundation for so many claims, alleged negligence.

[Note.—The foregoing paper, presented at the last annual meeting of the Canadian Electrical Association in Quebec, was illustrated by a car equipment kindly furnished by the Quebec Railway, Light and Power Company, as was also the current to operate same.]

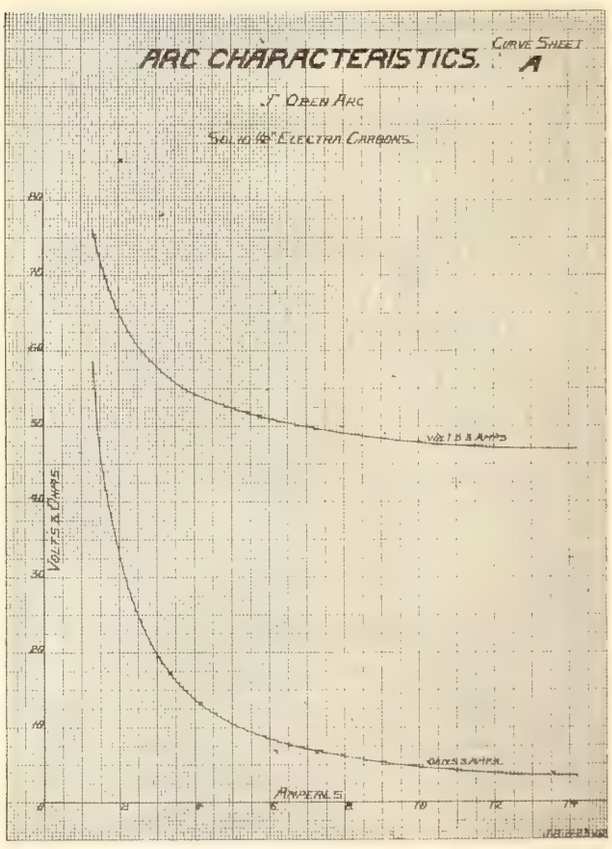
ARC LIGHTING.

By C. M. Green.

Arch light, now universally called "arc light," was discovered 100 years ago by Sir Humphrey Davey, 1802. It practically remained in the laboratory until 1877, when Charles F. Brush made its use possible to the commercial world by the following steps:

1st. The building of a dynamo suitable for operating a single arc lamp with a series magnet.

2nd. The multiple system of arc lighting, which consisted of

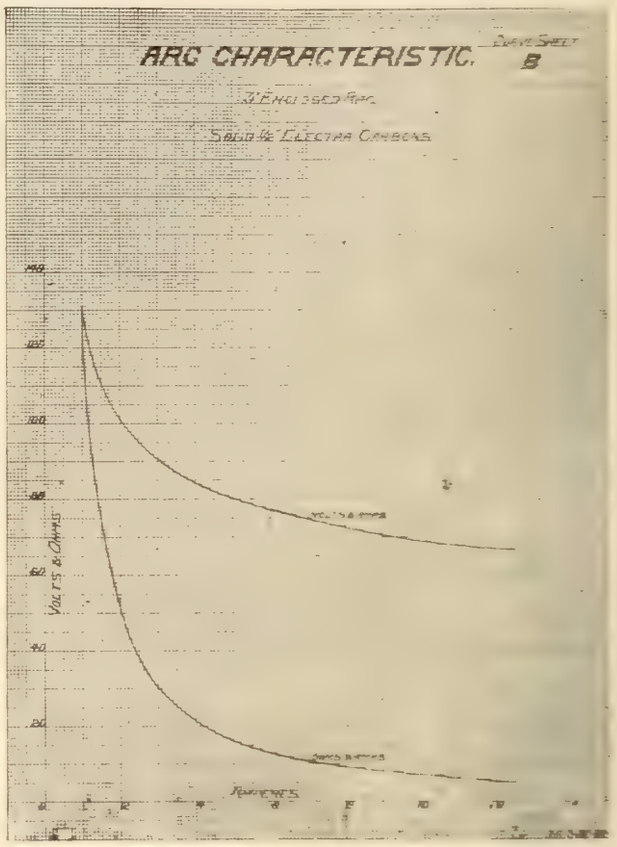


a dynamo with two or more separate circuits, with a lamp connected in each one of the circuits. This system, however, could never be commercially successful on account of requiring a separate circuit between the dynamo and each individual lamp.

3rd. The series arc lighting system employing a new lamp with differential windings, thereby keeping the voltage across the arc constant as the carbon burned away while the current remained constant in the circuit. An automatic cutout in the lamp for maintaining the circuit closed after the carbon had been burned away. The different circuits in the dynamo were connected in series and a current governor or dial designed to maintain the current constant from the dynamo as the load changed by shunting more or less current from its series field.

4th. Copper plating and in other respects improving and cheapening the carbons, thereby reducing the price from 26c. to 1c. each, thus reducing the cost of maintenance and greatly extending the commercial field for arc lighting.

It remained for Elihu Thomson to do the great work of de-



veloping not only the series system but the alternating system of arc lighting.

The arc lamps for constant potential circuits were developed several years later than the series arc lamps.

CLASSIFICATION OF ARCS.

The direct current open arc lamp was first invented and commercially developed, meeting with a very extended use and giving univeral satisfaction; first on constant current series circuits and later on constant potential circuits.

The alternating current open arc lamp has never met with any extended use for the following reasons:

1st. The light is very inferior in comparison with that obtained from the direct current, unless expensive cored carbons are used, and even then it is not equal to the direct current.

2nd. The arc and lamp mechanism are extremely noisy, some of the series street lamps being easily heard at a distance of 200 or 300 feet on a quiet night.

The direct current enclosed arc was commercially developed in 1895-96, having the following points of superiority over the open arc:

1st. The life of the carbons was increased from ten to twenty times, greatly reducing the maintenance and attention required by the lamp.

2nd. The steadiness and distribution of the light is vastly superior.

3rd. The light giving body is very much larger; the enclosed globe also diffuses much of the light, the result of which is that the shadows have been eliminated, approaching diffused daylight.

ARC CHARACTERISTICS.

The arc characteristics or properties must be known in order to understand and handle the arc successfully.

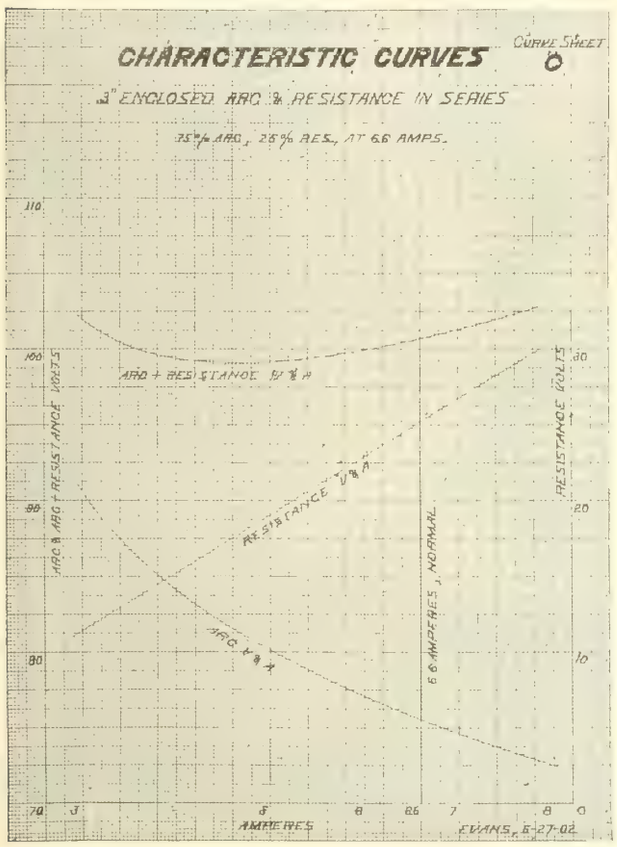
The characteristic curves of the open and enclosed arc are shown respectively on curve sheets A and B. These are plotted in volt and amperes, and also in ohms and amperes. The data for the curves was obtained in the following manner:

A direct current constant potential was used to supply the energy. The current was varied by means of adjusting the resistance in series with the arc. The length of the arc was kept constant by hand adjustment, a magnified image being projected on a screen for obtaining accurate measurements of its length. Weston voltmeters and ammeters were used in making the observations; each point on the curve is the mean of several observations. The ohms resistance were calculated from the volts and amperes. Both arcs show the same general characteristics. The volts and more especially the ohms resistance decrease rapidly with the increase of current, which I attribute to the following cause.

It is well known that the resistance of a conductor varies

directly as its length, inversely as its area and always varies with changes in temperature. The conductor in the arc is the vapor of carbon. In the experiments the length of the conductor or arc has been kept constant, the area of the conducting vapor varying with the current, the resistance also being reduced with increase of temperature due to larger area with proportionally less radiating surface. The temperature coefficient vapor of carbon is undoubtedly negative.

The weight of this conductor, the arc, is extremely



small. The rate of production of energy in the conductor is extremely high and also the rate of dissipation is correspondingly high, and accordingly the resistance varies almost instantaneously with the current. The time spoken of here may be taken as a small part of a second.

The resistance of the 6.6 ampere 60 cycle alternating arc has been investigated and the following results have been observed. Instantaneous current value 8.6 amperes, arc resistance 7.5 ohms, likewise the instantaneous resistance value at one ampere was 80 ohms with a rising current, but only 60 ohms with a falling current. From theoretical consideration I should expect that if the rate of change in current was sufficiently slow that there would be found no difference in resistance for a given current whether the current was rising or falling, and likewise if the change was made sufficiently rapid, as for example running up into the thousandths of cycles per second, that the change would be much less due to the smaller time element and the relative larger capacity of the conductor for storing up heat.

From the above it is very readily seen that the arc is extremely sensitive to current changes.

It is easily seen upon investigation of the characteristic curves that an arc will burn steadily upon a constant current supply or circuit but not directly across any constant potential supply, and also two arcs, not lamps, cannot be run in multiple.

The characteristic curves, A and B, clearly show that if the arc is to be stable it must be supplied from a source of electricity in which, if the current rises, the voltage will decrease, or if the current decreases the voltage will rise at a higher rate than shown in the characteristic curve.

The constant current supply is the best, requiring a lamp designed to keep the voltage at the arc constant and to maintain the circuit closed when the carbons burn out.

The constant potential supply is the poorest, requiring a lamp designed for accomplishing the following things:

1st. To supply the arc so that the voltage at the arc will drop as the current increases and rise as the current decreases and at a higher rate than shown in the characteristic curves. This is obtained by wasteful resistance or reactance.

2nd. To maintain the voltage and current constant at the arc by feeding the carbons.

3rd. If two or more lamps are to be run in series there will be required in addition to the above for each arc a load or resistance to be automatically substituted for it when the carbons burn out or the lamp is shut off, in order to maintain the circuit closed and to prevent excessive or destructive current in the other lamps.

Arc lamps run upon constant potential circuits, with a steadying resistance in series with them, have been built for a number of years. For operating upon a 110 volt circuit the voltage at the arc normally, being about 80, it is found that if it is raised above this by cutting out some of the resistance the lamp does not operate satisfactorily, jumps badly in picking up, and also the arc is very liable to break. Theoretically, this is comparatively easily explained by reference to Curve Sheet C, characteristic curves of .3" enclosed arc and resistance in series, 75% arc, 25% resistance at 6.6 amperes.

The characteristic curve of the arc in volts and amperes is shown upon the curve on a magnified scale, showing the resistance of the arc somewhat each side of the point at which it is desired to operate it. The volts loss in resistance with varying amperes is also shown upon the curve. The curve, arc plus resistance volts and amperes is obtained by adding the volts arc to volts resistance for the different current values.

Examination of this curve shows that between 4.2 amperes and 5.2 amperes that the current may be changed between these limits with practically no change in the voltage whatsoever, showing that there is no stability between these points, i.e., the current may vary between these limits with no change in the voltage.

Examination of the curve between 6 and 7 amperes shows that a change in voltage from 100 to 101.25 volts, or 1¼% rise in voltage, will increase the current 16.7% or from 6 to 7 amperes. In other words, the arc even with 25% of the line voltage consumed in resistance in series with it, is not particularly stable, and the more resistance we put in series with the arc the greater stability we obtain, but in an extremely expensive manner, since we are continually lowering the efficiency of our lamp.

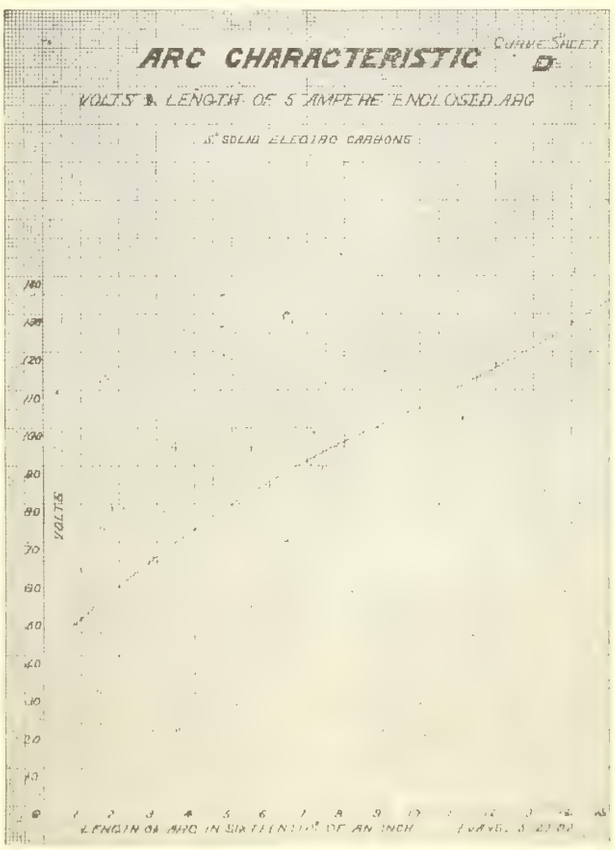
Curve Sheet D are characteristic volts and length of 5 ampere enclosed arc .5" solid electra carbons. A broad investigation of this curve shows that the volts at arc increase somewhat in proportion to its length plus about 40 volts. It apparently requires a certain number of volts to maintain an arc of extremely short length.

Investigation of this curve might lead to the opinion that the resistance of the arc might be kept constant by varying the length of the arc, but the arc is so extremely sensitive to variations in current that it is practically impossible to control the current in an arc lamp run across constant potential circuits in this manner.

The constant potential alternating arc lamps are invariably built with a reactance in series with the arc for steadying it, which has been found to be very much better than resistance for the following reasons:

1st. The lamp has a higher efficiency.

2nd. There is less distortion in the current wave supplied to a



lamp with reactance in series with the arc than with resistance. In other words, the power factor of the arc is higher and there is comparatively little difference in the power factor of the lamp.

There are no arc lamps in commercial use operated in multiple on a series circuit. This method would seriously complicate the lamp and wiring and also greatly increase the losses. Sometimes a resistance has been put in multiple with a series lamp on a series circuit as a makeshift. For example, a series enclosed arc lamp, 6.6 amperes, run on a 9.6 ampere open arc circuit when it was desired to compare the two lamps without going

to the expense of installing another dynamo and running on a separate circuit.

CANDLE POWER AND ARC EFFICIENCY.

Mr. W. D'A. Ryan, a great authority on the subject of Candle Power and Arc Efficiency, dealt with this subject very fully in the meeting of last evening. Accordingly, I shall simply mention briefly what appear to me five principal facts that he brought out.

1st. Of all the artificial lights the arc gives the one nearest approaching sunlight.

2nd. The great superiority of the enclosed arc in comparison with the open arc, better distribution of the light and also more light at a distance of 150 feet or more from the arc than that given by the open lamp, also the great absence of shadows. In other words it is the best artificial light which we have to-day.

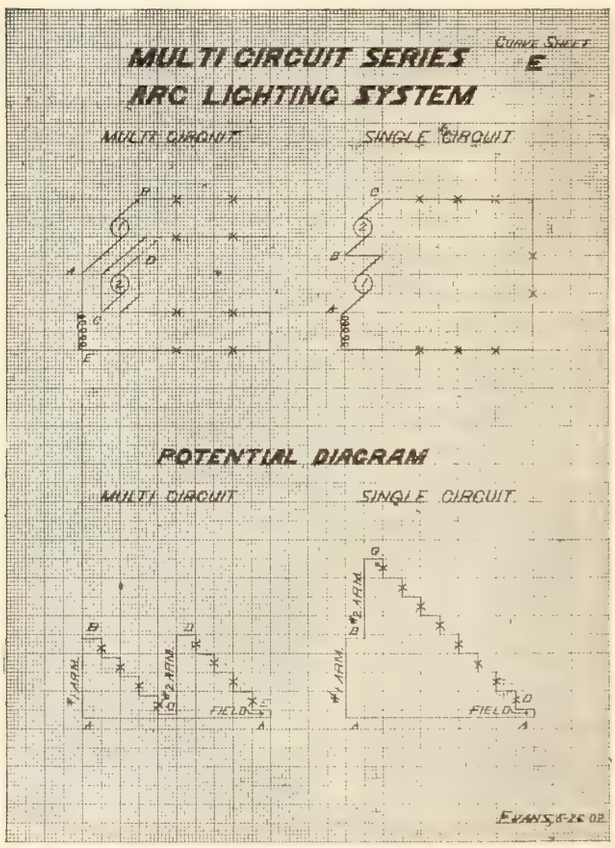
3rd. Great reduction in cost of maintenance of the enclosed over the open arc, the larger part of which is made up of carbons, followed by labor, with a few other smaller items.

4th. The enclosed lamp is more reliable, being entirely enclosed, and not affected by winds and snow.

5th. The design of lamps has been greatly simplified, the parts made interchangeable, the length and weight reduced—some of the greatest achievements of modern arc lamp engineering.

SUPPLY SYSTEMS AND TYPES OF LAMPS.

Generally speaking there are two systems of supply, the constant current series system and the constant potential or multiple system. The constant current or series system uses either direct or alternating current. Broadly speaking, there are only two types of lamps in commercial use to-day for the series system, namely, the differential and shunt lamps.



There have been many other kinds of lamps built embodying different methods of control, but none of them have the advantages of the differential lamp, the general details of which are well known to you all. The differential lamp I believe to be the best of the two for the following reasons :

1st. The lamp gives less trouble in operation. The characteristic curve of the lamp and that of the arc generators cross each other at full load, much nearer at right-angles than that of shunt lamp and generator, giving greater stability of operation.

2nd. The carbons are together and free when the current is turned on the lamp, whereas with the shunt lamp the carbons are separated and have to be brought together in order to establish the arc.

3rd. In case of an accident a generator may be largely overloaded with differential lamps by allowing the current to drop slightly, which will reduce the voltage on lamps, enabling a larger number to be run from the generator. Buffalo has run 100% overload in lamps in such cases, saving them large rebates to the city on account of keeping a large number of their lights in operation, which would have been impossible with shunt lamps.

It has been suggested that a shunt lamp possesses an advantage of operating at 6.6 amperes until midnight and at 5 amperes during the early morning hours. This is a fallacy. 95% of the central stations are committed by contract with the city or town to supply a specified current and wattage per lamp. The differential lamp is in harmony with this policy. Many central stations have an agreement with the city or town which has required them to equip their switchboards with recording ammeters which register the current at all hours.

The differential lamp is the most popular lamp to-day, and it is the general practice to build all series arc lamps with differential winding.

The constant potential or multiple system of distribution employing both direct and alternating currents, it is the universal practice of to-day to control all of these lamps by means of a series magnet, which makes the best and most economical lamp for this system. Lamps are built to run in series upon constant potential systems. For example, it is desired to operate arc lamps, a few of them only, on railway or 500 volt power circuit. In this case four or five enclosed lamps are run in series, but controlling mechanism is of the differential type, the current in the series magnet tending to separate the carbons, and the current in the shunt magnets controlled by the voltage across the arc operates in opposition to the series magnet, tending to pull the carbons together, or, in other words, it is a lamp built somewhat upon the plan of the best lamps to-day for series circuit with slight modifications as follows :

There is a steadying resistance always in series with the arc and also another resistance equivalent to the resistance of the arc which is automatically substituted therefor when the carbons burn out or it is desired to shut off the lamp.

GENERATING APPARATUS.

The generating apparatus is divided into two broad classes :

1st. Constant Current.

2nd. Constant Potential.

The constant current generators manufactured to-day are all direct current series wound machines with armatures either of the open or closed coil type. The Thomson-Houston and Brush arc generators are of the open coil type, and Fort Wayne and Western Electric of the closed coil type.

The regulation in these generators is always obtained primarily by armature reaction with the shifting of the point of commutation and brushes, with the following secondary refinements for keeping the current constant as the load changes:

(A) Varying the field excitation. Example, shunting more or less current from the series field and shifting of the brushes by an automatic regulator as found in the Brush arc generator, or varying the turns in the series field and shifting of the brushes by an automatic regulator as found in the old Excelsior or Hockhousen arc dynamo.

(B) Varying the armature reactions; using double sets of brushes on the commutator so that more or less turns in the armature can be cut out or run for a longer time in parallel, thereby changing the armature reactions. The Fort Wayne or Wood arc dynamo is an example of the first case, the T. H. arc dynamo of the second, the brushes being controlled in each case by an automatic regulator.

Generators in which the secondary regulation is secured by varying the field excitation are theoretically of higher efficiency than those in which the regulation is secured by varying the armature reactances.

There is comparatively little difference in the two methods as far as losses go whether the field excitation is changed by means of shunting more or less current or commutating the field.

Generators with open coil armatures are in my opinion superior to those with closed coil armatures in the following respects:

1st. The voltage at the terminals of the generators on breaking of the circuit will not rise over 20% above the maximum voltage which the machine will supply at normal current, whereas with machines of the closed coil type, the voltage rise is very much greater, in fact, so much so that certain machines of the closed coil type have been provided with spark gaps in order to prevent the voltage from rising excessively high when the circuit is opened.

The low voltage rise on the open coil generator is due to the fact that when a slightly greater load is thrown on the machine the point of commutation is drawn back under the brush and the generator then flashes over, short circuiting the armature, but doing no damage ; while the generator with the closed coil armature flashes over at a very much higher voltage with the liability of breaking down the insulation, short circuiting some of the armature coils or commutator segments, to be followed by burnouts.

2nd. The great reduction in the number of commutator segments in comparison with generators of the closed coil type. For example, the Brush arc generator has only 32 segments as compared with five times as many on generators of some other types.

THE CONSTANT CURRENT SERIES ALTERNATING SYSTEM OF ARC LIGHTING.

Alternating constant current generators are not built to-day, but constant current transformers are run on constant potential alternating current generators, for obtaining constant current from constant potential generators and always in connection with some other service on the generators.

These generators are too well-known to be taken up here.

The constant current transformer is designed with movable secondary or primary coils for varying the voltage from secondary with constant current in it as the load changes. This is accomplished by varying the impedence and secondary voltage in the transformer by changing the relative position of the coils.

Mr. Greene is the inventor of the British Multi-Circuit Machine

The current in primary and secondary coils being in the opposite direction, they repel each other. The repulsion varies with changes in current and is balanced by weights attached to the movable coil. When the load is increased the current drops, the repulsion is reduced, and weights bring the two coils closer to each other, thereby bringing the current back to normal value. If the load is reduced the operation is reversed.

The constant current transformer requires the same amperes supply, irrespective of its load. The power factor, however, changes with the load.

Constant current transformers are built for single or multi-circuits. The arc circuits are always insulated from the supply circuits and never more than two multi-circuits run in series, thereby greatly reducing the liability of interruption in the service by grounds, one ground on every circuit not interfering with the service except on the multi-circuit, and one ground on the two circuits here does not affect the service.

Series arc lamps are run with a variable reactance in series with them, for maintaining the current constant across constant potential alternating mains,but the trouble due to grounds upon a large system of this nature makes the service very unreliable, so much so that this system has never come into extensive use.

When it is desired to operate arc lamps from large polyphase systems of distribution, employing 25 cycles, a motor generator set is usually installed, since the light from a 25 cycle arc is very unsatisfactory, fluctuating unless a polyphase arc is used; also the lamp is complicated and must be designed for low voltage on account of danger and expense involved if high voltages were introduced into lamps between phases, which means an expensive and complicated system of wiring and transformers, which has not been developed. A lamp could be built with comparative ease for 110 volt circuits, but the field is small.

THE MULTI-CIRCUIT SERIES ARC LIGHTING SYSTEM.

The multi-circuit series arc lighting system was invented in February, 1896, and was exhibited at the Electrical Exposition in New York in May, 1896.

This invention has been widely used on arc generators and its use on constant current transformers is increasing rapidly.

Curve sheet E shows the connections of the multi-circuit and single circuit systems. It consists in dividing up the generator and load into two or more parts, interposing the parts in a series combination, readily understood by examination of the curve sheet.

The single circuit arrangement is shown in the diagram to the right, from which it will be noted that the two armature circuits are directly connected in series with the field between D and C. The lamp load is connected between C and D.

The object of the multi-circuit system is to reduce the voltage or increase the capacity of the generator without increasing the voltage, and this is accomplished as shown on the potential diagram on Curve Sheet E.

It is a well known fact that the algebraic sum of all the electro motive forces in any circuit is equal to zero. We have plotted on the curve sheet the potential diagram for the multi-circuit and single circuit connections, which shows that the two circuit multi-circuit machine carrying the same load as a single circuit machine reduces the voltage practically 50 per cent.

The writer has also run other arc dynamos connected multi-circuit.

Constant potential generators are too well known to be discussed in this paper. They were developed for an entirely different service; but it is frequently desirable to operate arc lamps from them, but always in connection with some other service, and forming but a small part of their load.

PLANT EFFICIENCIES AND LOSSES.

ENCLOSED ARC LAMPS CONSUMING ABOUT 480 WATTS.

System	Series		Multiple	
Current	Dir.	Alt.	Dir.	Alt.
Light	1.00	.98	1.00	.98
Lamp	.95	.94	.727	.89
Line	.95	.935	.90	.90
Generator	.88	.93	.94	.93
C. C. Transformer		.96		
Power Factor		.78		.71
Cycles		60		125
Plant Efficiency	.794	.768	.615	.73

CONCLUSIONS.

1st. The enclosed arc is better and cheaper to operate than the open arc.

2nd. The direct constant current enclosed arc system is best and most economical for plants devoted exclusively to arc lighting.

3rd. The alternating constant current enclosed arc system is best and most economical for plants which use large 40 to 125 cycle alternating current generators, the arc lamp load being a small part of the total output of the station.

4th. Constant potential direct and alternating current arc lamps are very extensively used on constant potential systems of distribution for inside lighting, and somewhat for street lighting, but only when there are special reasons for so doing.

FUTURE DEVELOPMENTS.

There is great need of a rectifier apparatus for transforming three-phase 25-cycles constant potential into direct constant current for series arc lighting, which shall cost less and have a higher efficiency than the motor-generator sets of to-day. I believe it is only a question of time when we shall have a commercial rectifier.

Single phase rectifiers have been in use for some years in Europe, but with enclosed lamps there is little advantage in rectifying the current, and the apparatus is much more complicated.

We are living in an age of inventions or discoveries. Someone may invent or discover a new lamp which will greatly increase the light obtained per watt.

As a matter of interest, I desire particularly to call your attention to the present arc lighting situation at Buffalo, N. Y., and other places.

The Buffalo General Electric Company were among the very early users of arc apparatus and have been operating it for upwards of twenty years,during which time very radical changes and great improvements have been made in arc apparatus. They are at present using upwards of 3500 open arc lamps, the current for which is supplied by 26 arc dynamos, each rated at 6250 volts, 9.6 amperes, 500 revolutions per minute. These generators are driven by three-phase synchronous motors, the current for which is supplied from Niagara Falls.

The managers of the Buffalo Company have decided to change their system of arc lamps, and the subject, both financially and otherwise, being a very important one, they have made a very careful examination of the present arc lamp situation and have decided to rewind their 26 arc generators for 8500 volts, 6.6 amperes, and to adopt the enclosed direct constant current series arc lamp.

The direct and alternating current systems of series enclosed arc lighting were very carefully investigated and it was found that the cost of changing over the present arc generators frem 9.6 amperes to 6.6 amperes would amount to about half as much as to purchase alternating current generators and constant current transformers.

I might call attention to the fact that the supply from Niagara Falls is 25 cycles, which is entirely unsatisfactory for operating arc lamps, the frequency being too low, which necessitates either a frequency changer or a motor generator set in order to get satisfactory current for operating arc lamps. Furthermore, the efficiency of the arc generator, equipped with laminated pole shoes and armature shield, will be practically the same as the alternator and constant current transformer. The direct current line losses will be much less, since they would require 7.5 amperes in place of 6.6 amperes for their arc lighting circuits, in order to give the same number of watts in the lamp or arc.

Boston has been operating the series direct current enclosed arc system since 1898. They have in use 50 arc generators, 8500 volts, 6.6 ampere, 500 R. P. M., direct connected to synchronous motors. Capacity, 6000 enclosed arc lamps.

Toronto has been operating for a number of years arc lamps, the current for which has been supplied by arc generators. I should not be at all surprised to see these generators rewound for 6.6 amperes for lighting the streets of Toronto with enclosed lamps,the generators to be driven in the near future by synchronous motors supplied with power from Niagara.

Parties who are interested in changing over their open to enclosed arc lamps should give due consideration to the direct constant current enclosed series arc lighting system. While they are operating at present a number of small arc machines they could make a large saving by the introduction of large size units.

Where their present system already consists of large units wound for 9.6 amperes the machines can be rewound for operating enclosed arc lamps, affording a great opportunity for effecting economies and improvements.

CONVENTION NOTES.

The Ladies' Committee were indefatigable in their efforts to give the lady visitors a good time, and they succeeded admirably.

The town of Levis erected on the bank of the St. Lawrence in honor of the visitors a mammoth electrical sign bearing the word "Welcome."

It was a matter of general regret that on account of illness in his family Mr. Frederic Nicholls was prevented from being present at the meeting,

The supply firms were well represented both in numbers and in ability and good fellowship. The United States contingent was quite as large as the Canadian.

Mr. Marconi was unfortunately not able to attend and present a paper at the Convention as he had expressed a wish to do. It is to be hoped that he may be able to take part in next year's Convention at Tor-

onto. The coming year should witness further interesting developments in the field of wireless telegraphy.

The Quebec Railway Light and Power Company has in Mr. Evans a very able and wide awake manager. In consequence the service is thoroughly up-to-date and grows increasingly profitable.

As a very suitable memento of the Convention the Mechanics' Supply Company distributed a set of very handsome souvenir or private post cards illustrative (in color) of prominent Quebec views. They were very much admired.

The unavoidable absence of Mr. A. B. Smith, of the G.N.W. Telegraph Co. was a matter of regret to his many frieuds in the Association, who showed their appreciation of his past faithfulness and efficiency by re-electing him to the Executive Committee. This was the first Convention of the Association at which Mr. Smith was not present.

The menu card for the Association banquet was a unique production, and was among the most highly prized souvenirs of the convention. It showed the Citadel, the Chateau Frontenac, the Dufferin Terrace, the Embankment, the St. Lawrence and the steamer Quebec in their natural position in relation to one auother. The steamer and Chateau were cut out in cardboard. On the reverse side of the card. which was arranged to fold up, was printed the menu and toast list.

Among the attractive and useful souvenirs of the Convention distributed by the manufacturing companies was a match holder in the form of a transformer, by the Canadian General Electric Company; a pocket memorandum book with celluloid covers, bearing on the front figures representing Industry, Art and Commerce and the compliments of Mr. John Forman, and on the back an illustration of the Gutman Standard Wattmeter; a daily directory by the Bullock Electric Mfg. Co. of all persons in attendance with a number opposite each name corresponding to the number on a button supplied to and worn by each member and visitor. By reference to this unique directory and the numbered buttons, the identity of persons in attendance could be readily ascertained.

The decorations both in the rotunda of the Frontenac hotel and on Dufferin Terrace, put up by the National Electrical Improvement Company, of New York, under the direction of Mr. Russell Spaulding, General Manager, were of a very attractive character and were greatly admired. The "Elblight" system of which this company are the owners, is especially adapted for work of this description, and permits of an attractive display at small cost. The lamps are fitted with sharp pin terminals which pierce the insulating material and make contact with the cables, which are made up of strands of wire put together in such a way as to make contact certain wherever the lamp may be placed. The ingenuity and usefulness of the system attracted much attention. It is understood that the National Electric Improvement Company are seeking to establish a Canadian company to manufacture in this country.

AN IMPORTANT CONSOLIDATION.

After protracted negotiations the Lachine Rapids Hydraulic & Land Company, of Montreal, and the Shawinigan Water & Power Company, of Shawinigan Falls, Que., have come to an agreement by which the latter corporation will deliver power to the city of Montreal and surrounding municipalities to the Lachine Company for distribution. The deal is of great importance, as it places the Lachine Company in an excellent position to supply almost any demand for power which may be made upon it. The contract is for twenty-five years, with privilege of renewal for twenty-five more.

According to the contract the Shawinigan Company agrees to deliver all the electrical energy demanded by the Lachine Company, and it is further understood that the two companies shall retain their present identity and that there shall be no intermingling of management. The present development at Shawinigan Falls is about 35,000 horse power, but conservative estimates place the maximum at 100,000 horse power. The Shawinigan Company is now engaged in constructing a transmission line along the Great Northern Railway Company's right of way between Shawinigan Falls to Joliette, and from thence over the Chateauguay and Northern Railroad and the Montreal Terminal Railway Company's right of way into the city of Montreal. Immediately at the outskirts of the city a sub-station will be built, into which the current will be carried from the transmission line and transformed to suit the requirements of distribution.

QUEBEC PROVINCIAL ASSOCIATION OF STATIONARY ENGINEERS.

At the annual meeting of Montreal Association No. 1 the following officers were elected: President, J. T. Murphy; 1st Vice-President, J. E. Jones: 2nd Vice-President, J. O. Rourke; Treasurer, T. Ryan; Recording Secretary, Wm. Smyth; Financial Secretary, H. Nuttall; Corresponding Secretary, R. Marchand; Conductor, A. Adams; Door Keeper, G. A. Adams; Librarian, Wm. Ware; Educational Instructor, E. Valiquette; Trustees, Wm. Ware, J. J. York, F. D. Jones.

There was a good attendance of the members. All the offices were closely contested, which speaks well for the interest taken by the members in the meetings. A new era of prosperity seems to have dawned upon the Engineers of Montreal since the amalgamation of all the societies and the forming of an Executive Board. The educational feature promises to be an interesting one in future under the able leadership of Bro. Valiquette. A paper is read each night by some brother and discussed on the black board, when a wide range of ideas and opinions are brought out. The executive also offer prizes for the best papers on certain subjects. The present one is, "What are the duties of an Engineer!"

ONTARIO ASSOCIATION STATIONARY ENGINEERS.

The annual meeting of the Ontario Association of Stationary Engineers was held in the Engineer's Hall, Toronto, on May 26th, at which the reports of the Registrar and Treasurer were received. The Registrar reported the total number of certificates issued as 1,075, of which 100 will cover lapsed certificates and deaths. The Treasurer reported funds to the amount of $229.00 on hand.

A report was submitted from the Legislation Committee setting forth the action of the Governments' amendments to the Factories Act and showing that the amendments in their present form are not much use to either the steam user or the engineer. A strong committee was appointed to take the matter up at the next session of the Ontario Legislature. It was also ordered that the Union label be placed upon all printed matter done for the Association. The Board Members elected were Messrs. F. W. Donaldson, Toronto; F. G. Mitchell, London; W. F. Chapman, Brockville; J. G. Bain, Toronto.

The officers elected by the Board were, President, F. W. Donaldson; Vice-President, Chas. Mosley; Registrar, J. G. Bain, 113 Yorkville ave., Toronto; Treasurer, A. M. Wickens, Toronto. The business of the day was concluded in time for the members to take the evening train for their homes.

The annual meeting of the Montreal Light, Heat & Power Company was held in Montreal last week. The chairman stated that the present year had every promise of being even more profitable than the one just closed. There had been some delay in completing their new transformer plant on Queen street owing to inability to secure machinery. The development of the water power of the St. Therese Rapids, three miles above the Chambly power house, would materially increase the company's capacity and would do away with the interference of frazil ice. The old board of directors was elected.

A QUEBEC ELECTRIC SUPPLY HOUSE.

The largest electrical supply house in Quebec is that of the Mechanics' Supply Co., of which Mr. W. H. Wiggs is the sole owner and manager. He is ably assisted by his head clerk and buyer, Mr. Guy Simpson.

Owing to the introduction of several new electric companies into Quebec within the last few years the demand for electrical material has been considerable and early recognizing this demand the Mechanics' Supply Company added a very extensive electrical stock in charge of competent and trained clerks.

In addition to electric lighting supplies they also carry a full line of telephone and telegraph material and are now making arrangements for the introduction of wireless telegraph and telephone material as soon as these systems are on the market.

One of the reasons of Mr. Wiggs' success is his firm belief in the use of judicious advertising and printers' ink, and some of his samples of printed matter which we have seen are second to none in Canada or the United States.

The Company are extensive importers of electroliers, shades and glassware of all kinds from England, Germany, Austria and the United States.

It is a great advantage to any community to have such an establishment as this at their disposal.



The Mechanics' Supply Company's Show Room, Quebec.

PERSONAL.

Mr. Arthur Cox, for many years treasurer and superintendent of supplies for the Great Northwestern Telegraph Company, has decided to resign his position this fall, and will spend the winter pursuing his art studies in England and France. His long connection with the above company brought him in contact with the business men of Toronto and the country at large, who will regret to learn of his contemplated removal from Canada.

Mr. R. C. C. Tremaine, manager and part proprietor of the electric plant at Exeter, Ont., died at his home in that town a fortnight ago, of peritonitis. Mr. Tremaine was but 27 years of age. He was a graduate of the School of Practical Science, Toronto. After graduating he spent a short time in the Maritime Provinces, removing to Exeter about five years ago and becoming joint proprietor with Mr. Charles Shell in the Exeter Electric Light Company. He had become most popular in the town and will be greatly missed in social and business circles.

The Toronto branch of the Canadian Stationary Engineers have elected the following officers for the ensuing year: President, R. H. Johnston; Vice-President, James Bannon; Recording Secretary, W. H. Johnston; Financial Secretary, N. V. Kulham; Treasurer, S. Thompson; Conductor, R. T. Liddell; Door-keeper, W. G. MacLean. Trustees—James Bannon, Wm. Outhwaite, T. B. Bly. Representatives to convention—N. V. Kulhman, A. Storer, W. J. Webb, and R. H. Johnston. The annual convention of the Association will be held in Toronto next month.

MONTREAL

Branch office of the CANADIAN ELECTRICAL NEWS,
Imperial Building,

Montreal, July 5th, 1902.

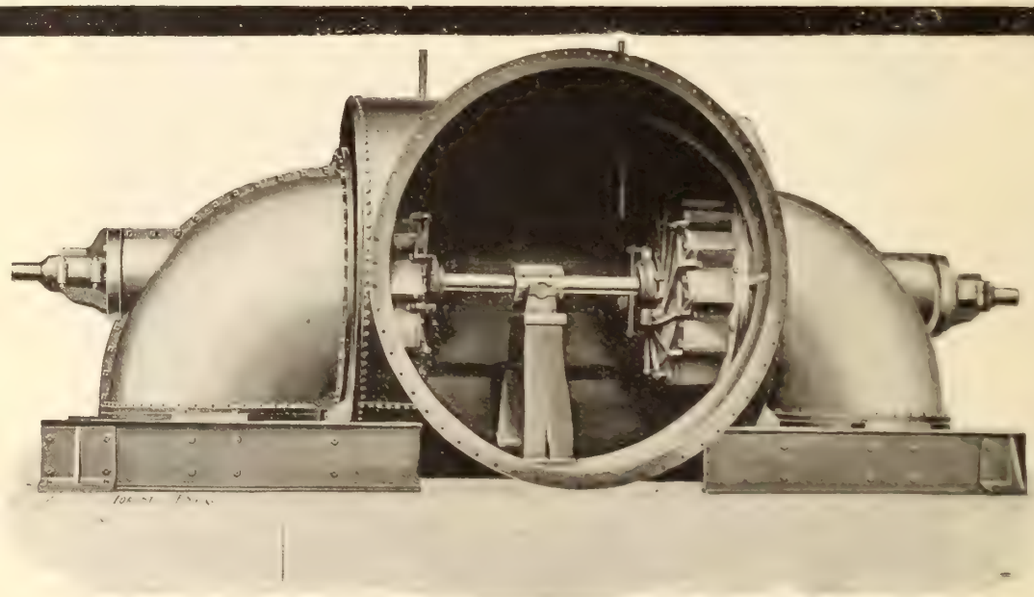
An understanding as to prices has been arranged by the various Montreal supply houses on "staple goods" such as wire, rosettes, sockets, cord and the like. The prices are based on a sliding scale as regards quantity purchased. The legitimate contracting firms are not at all satisfied, claiming that on our hand there is nothing to justify the enormous advance even on maximum quantity list from prices they heretofore sold at. The minimum quantity list is again not scaled high enough to give the contractor who does not carry much stock, adequate protection from the public at large. The question of "who is a contractor" has not been looked into sufficiently as the "tramp" in many instances has been receiving most favored nation treatment.

By a strange irony of fate the employee of an electrical concern in Toronto who as "walking delegate" to the Electrical Workers' Union, came down here some months ago to (unsuccessfully) engineer the strike will be having his hands full right at home if what the newspapers tell us about the strike in Toronto be true. How would the Toronto fraternity like a Montrealer sent up there now to stir up strife ?

The practice of several large companies of filling vacancies when such occur by Americans is strongly to be condemned. We have just as good in Canada, not to speak of the fact that the "assistant" to such "head of a department" is somewhat familiar with the work (to say the least) and should be given a "show." Nothing takes the heart out of a man quicker than to see Americans dropped in over his head without rhyme or reason and his chances of advancement (no matter how hard he works or attentive he may be to his duties,) made practically nil.

Here is a sample of contract wiring as it is done in Montreal : A contracting wireman installs 15 outlets, "skeleton concealed" work, at the rate of 75 cents per outlet. This comes to $11.25 ; out of this he pays $7 for inspection and certificate leaving him net $4.25. Query—Where does he buy his material and what wages does he pay ?

The Electrical Contractors' Association for the Province of Quebec has just lately organized, the first regular meeting having been held on 23rd June. The object of the Association is to get proper recognition for the legitimate contractors, and interchange of views, etc., among its members. As considerable jealousy has heretofore existed, it is our hope that the boys by the formation of this Association will get together, know one another better, and furnish mutual aid. The step is a good one and may lead to greater things in the future than at present imagined. The following officers have been elected for the ensuing year:—President, Wm. B. Shaw, of Montreal Electric Co.; Sec'y-Treas., Geo. S. Hill; Executive Committee, W. H. Scott, of J.E. Scott & Co.; G. N. Brock of Collyer & Brock; Jas. Bennett, of Bennett & Moncel; among other firms not already mentioned above, the following are interested in the success of the Association:—Sayer Electric Company; Telfer, Telfer & Company; Edwin C. Lewis Company. The intention later is to show its workings and by-laws to those interested in Toronto, have them do likewise and affiliate.



The above plate shows a pair of 35 inch Crocker Turbines, in horizontal setting, outward discharge type. This arrangement can be placed in any part of the line of shafting, when circumstances permit of direct connection, power being taken off on both sides of the case if desired. We have designs for many other styles of setting. Estimates and catalogue promptly forwarded to those applying and stating conditions under which power is to be developed.

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32 Lansdowne St.
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CANADA.

Painted bus-bars for ready identification are a safety precaution taken in a central electric station at Essen, Germany. This pertains to the high-tension bars behind the switchboard, which are all of bare copper strips, painted distinguishing colors and carried 8 feet above the floor on porcelain insulators. The generators are 5,000-volt machines and the 5,000-volt bars are taken round three side of a fuse room at a height of 2 feet from the floor, for convenience in inserting and pulling fuses. The latter are in sealed glass tubes about 1 foot long and about 2 1-2 inches in diameter, with substantial end contacts, each containing three fuses enclosed in small tubes with cement powder arc deadeners. The fuse tubes are put in or pulled out by the the attendant with a pair of large wooden tongs about 3 feet long, which grip the tubes. The mains are so arranged that the fuse tubes are on an incline for greater convenience in handling. The room contains nothing besides the live bars and the fuses, leaving a large open space in the center.

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To represent a syndicate of American Manufacturers of Electrical power and lighting machinery and fittings. A man of technical education and thorough knowledge of the Canadian electrical trade. Commission only. Address, MILLER, 88 Maiden Lane, New York.

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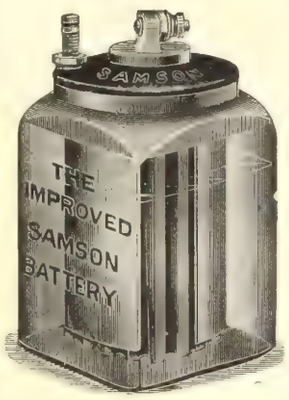
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Head Office American Works, 91 Gold St. New York City.

Improved "Samson" Battery

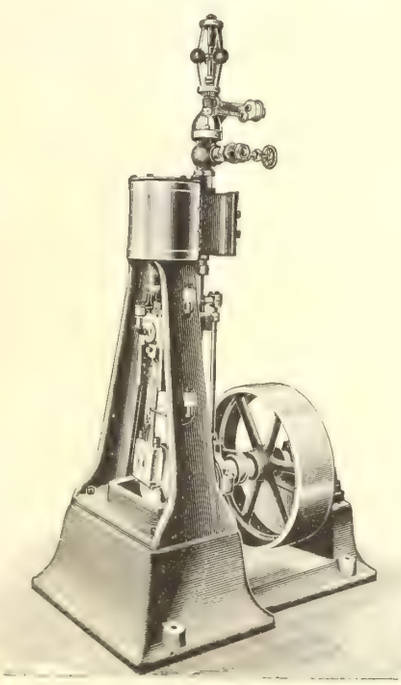


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MECHANICS' SUPPLY COMPANY

96 St. Peter Street, QUEBEC.

SPARKS.

Tenders were recently invited for the lighting of the village of Lakefield, Ont., by electricity.

The town council of Magog, Que., has decided to install another dynamo for the electric light plant.

The first demonstration test of the Hatch electric smelter at Parry Sound, Ont., was made recently and was found satisfactory.

The Halifax Tramway Company have secured the contract for lighting M. M. dock yard. A large number of incandescent lights will be required.

The Canadian Pacific Railway has purchased the Hull and Aylmer electric road. The purchase price is said to be between $700,000 and $800,000.

The annual meeting of the New Brunswick Telephone Company was held at Fredericton, N.B., on June 10th when the usual dividend of 4 per cent. was declared.

The assignment is announced of the Standard Electric Company, manufacturers of electrica supplies, Toronto. The company was composed of W. E. Smiley and A. E. Brock.

The tender of the International Telephone Company of Chicago, has been accepted for furnishing a telephone system for Port Arthur and Fort William, Ont. The price is $5,475.

The town council of Campbellton, N B., has decided to largely increase the electric light plant, to which end prelimiary arrangements are now being made. Mr. H. G. V. Farrer is manager of the plant.

An agreement has been reached between the town council of Sault Ste. Marie, Ont., and the International Transit Company by which the latter agrees to have electric cars running in the town by October next.

A small leaflet entitled "Accuracy" which has reached our desk gives a general description of the new type "G" Scheeffer recording watt meter manufactured by the Packard Electric Company, of St. Catharines, Ont.

Mr. E. S. Harrison states that tenders for preliminary construction work on the proposed electric railway between Winnipeg and Headingly, Man., will be called for immediately. There will be four divisions of 2¾ miles each.

The town council of Cookshire, Que., has decided to purchase the water power on the St. Francis river situated a few miles above Angus. It is proposed to develop the power electrically and transmit it to Cookshire, a distance of twenty miles.

Mr. W. Meredith, a young engineer from the United States, has been engaged to design the proposed power development to be carried out by the Vancouver Power Company at Coquitham Lake, B.C. It is expected that the work of construction will occupy about two years.

The Ottawa & Hull Power Company expect to complete their works in about three months, when they will have developed 12,500 horse power of electrical energy. The construction of the stone house is well advanced. Five dynamos of 2,500 horse power each will be installed.

The Central Ontario Power Company, of which Mr. J. A. Culverwell is managing director, has purchased outright Buckhorn Falls, 18 miles from Peterborough, where 2,000 additional horse power will be developed and transmitted to Peterborough and surrounding towns.

The St. Lawrence River Electric Company, Limited, is a new company recently incorporated, with a capital of $250,000, the directors being Messrs. M. W. Beach and W. L. Redmond, of Iroquois; W. H. Meldrum, of Peterborough; Irwin Hilliard, of Morrisburg; and D. A. King, of Winchester.

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The Westinghouse Integrating Wattmeter is sold by

AHEARN & SOPER LIMITED,
Ottawa, Canada.

The General Electric Company, of Schenectady, N. Y., has purchased the property in Ottawa formerly occupied by the Ottawa Porcelain & Carbon Company, and will utilize it for the purpose of a mica factory. About 400 hands will be employed.

It is proposed to install an electric light plant in the opera house of St. John, N. B. Mr. J. F. Dockrill is now getting estimates on two belt driven generators of 500 16 c. p. lights capacity each. Of these 250 lights will be required for the opera house, leaving 750 for commercial use.

TELEPHONE POLES FOR SALE

THE UNDERSIGNED HAVE IN STOCK, and ready for shipment, 2,000 Cedar Telephone Poles, all lengths, 25 to 60 feet. Prices quoted by mail or wire for car lots f. o. b cars this station or delivered at points required.

GEORGE & McGREGOR,
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One lot of Wood and Iron Pulleys.
One lot of good 2nd hand Belting.
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1 25 light Reliance Arc Dynamo in first-class condition.
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3 10-light Shellenberger Watt Meters.
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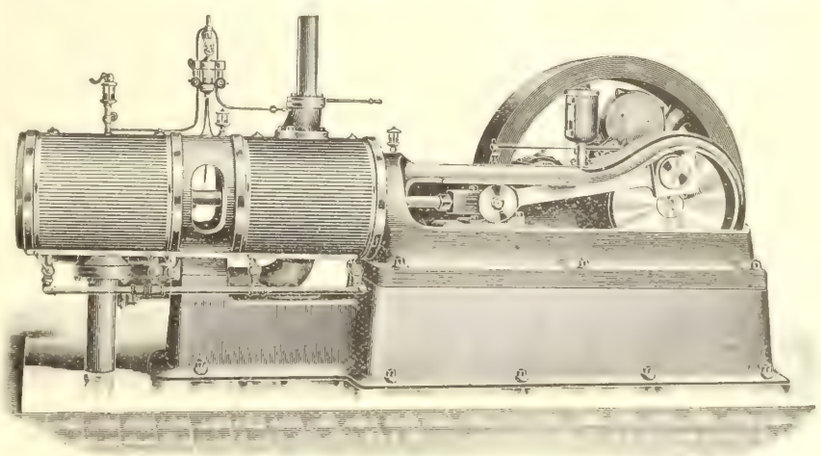
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BY THE WAY.

Mr. J. J. Wright, manager of the Toronto Electric Light Co. is one of the veterans of the electrical business on this continent. He was associated with Prof. Elihu Thomson in the development of some of his earliest discoveries. The Professor was at that time principal of a high school in Philadelphia, and hesitated somewhat before deciding to relinquish his modest salary and take his chances in what he regarded as a very uncertain field. A short time ago Mr. Wright paid a visit to the great factories of the General Electric Co., at Schenectady, N. Y., and as he looked round upon the mammoth concern with its thousands of employees recalled to mind the time when he was the only employee of what was then the Thomson-Houston Company.

× × ×

The Egyptian pyramids are soon to come out of their darkness of 5,000 years, and will be accessible to all tourists, says the New York Evening Post. General Director Maspero, of the Society which has in charge the preservation of the antiquities of the country, has been experimenting with the electric light, and began his work on the Temple of Karnak, at Thebes. The experiment met with so much approval, that he has decided to light the inner passages and catacombs of the great pyramids. This will provide Egyptian tourists with new attractions, and they will be able to penetrate to the innermost recesses of the pyramids. The lighting will be of especial value to women, who have confined their investigations of the pyramids of the left shore of the Nile to climbing up on the outside, as they were afraid of the intense darkness within. With the introduction of the electric light, the tombs of the Pharoahs will be accessible to all.

The town council of Campbellton, N. B., have recently purchased one 100 k.w. S.K.C. generator from the Canadian General Electric Co. This plant is under the management of Mr. Hiram G. V. Farrer.

CANADIAN TURBINES



are thoroughly reliable drivers for Electrical, Mill and Factory Purposes. We give full results in practice as well as in tests.

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Plans and Specifications submitted

SPARKS.

The annual meeting of the Parrsboro Telephone Shore Company was held at Parrsboro on June 5th. A dividend of 10 per cent. was declared on the year's work of the Shore line and of 5 per cent. on the line to River Hebert for the six months it had been operated by the company. Officers for the ensuing year were elected as follows : President, A. W. Atkinson ; secretary-treasurer, James W. Day; managing director, Capt. Johnson Spicer; directors, Percy L. Spicer, Robert Dewis, Thos. H. Armstrong, R. L. Dewis.

Tenders were recently invited by the Montreal City Council for electric power for operating the new pump at the high level reservoir. There were only two tenders. The Montreal Light, Heat & Power Company offered to furnish the power at $21.50 per horse power from 7 p.m. to 7 a.m., with half a cent for every additional hour, or from midnight to noon at $26, plus half a cent for every additional hour. The Lachine Rapids Hydraulic & Land Company tendered at $20 per horse power, from 10 p.m. to 10 a.m. plus $2 for every additional horse power, and on a three or five year contract from 3.30 p.m. to 5 a.m., at $25 per horse power, with $1 for every additional hour on a total of 40 horse power.

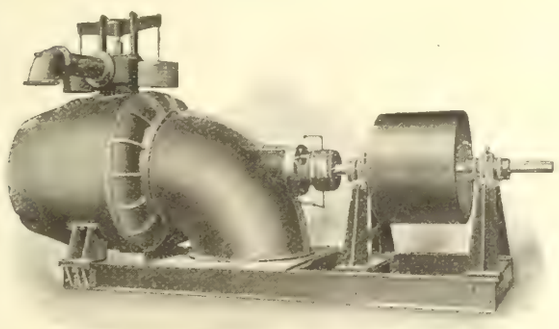
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On horizontal shaft is shown by the cut herewith. The water is discharged through one end through the draft tube, and in this case the usual end thrust connected with single wheels is entirely provided for.

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SPARKS.

The Canadian General Electric Company have opened a branch at Ottawa.

A new switch-board may be purchased for the municipal electric light plant at New Westminster, B.C.

It is reported that a company will be formed for the purpose of building an electric railway from Ottawa to Lachine.

The Canadian General Electric Company will supply an electric light plant for lighting the town of Edmonton, N. W. T.

Mr. F. Deagle has secured the franchise to supply electric light and power to Eugenia, Flesherton and Flesherton Station.

It is the purpose of the Canadian Pacific Railway to build an electric power house at Fort William, Ont., although the plans are not yet complete.

The light commissioners of Brockville, Ont., have taken tenders on the supply of new dynamos, boilers, engines, etc., for the electric light plant.

The town council of Barrie, Ont., proposed to raise $6,000 to provide for improvements to the electric light plant, but the ratepayers voted it down.

The Canadian General Electric Co. has purchased the Murdock property in Halifax, N.S., and a portion of the building will be converted into modern offices for the company.

Mr. H. E. Maulson has offered to form a company with a capital of $20,000 for the purpose of operating telephone and electric light plants in the town of Minndosa, Man.

It is reported that the Westinghouse Air Brake Company, of Hamilton, purpose engaging in the manufacture of electrical machinery there.

W. A. and G. L. MacKay have established business at North Sydney, N. S., as dealers in electrical supplies, under the style of W. A. MacKay & Company.

A by-law granting a bonus of $10,000 to the Windsor, Sandwich & Amherstburg Electric Railway was carried by the ratepayers of Amherstburg last month.

The municipalities interested in the proposed Huron, Bruce and Grey Electric Railway are holding meetings for the purpose of discussing the situation. At the last session of the Legislature a charter was granted for this road, to run from Wiarton to Owen Sound, with branches to Seaforth and Blyth.

The difficulty between the Cataract Power Company, of Hamilton, and its employees regarding wages is to be settled by arbitration. The company has chosen Mr. Alexander Bruce, K.C., as its arbitrator, while Rev. C. E. Whitcombe will represent the men and a third arbitrator will be chosen by these two.

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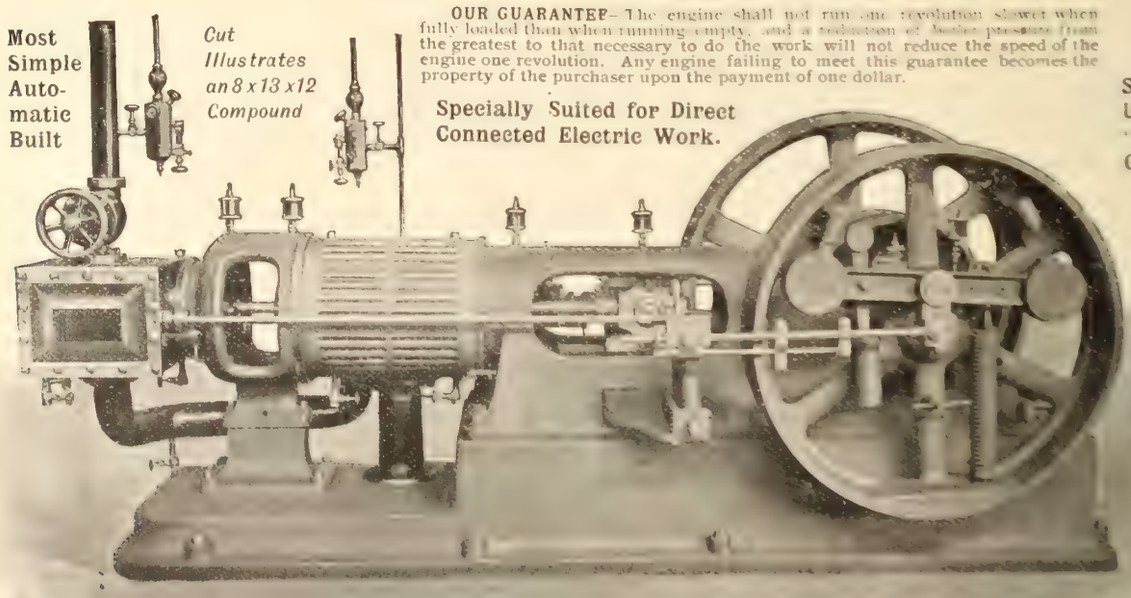
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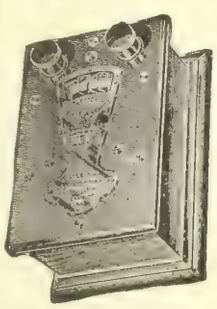
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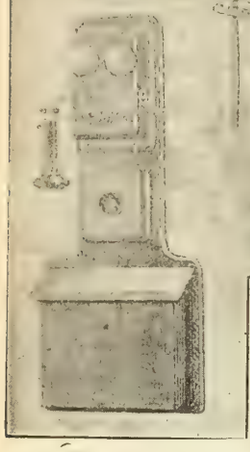
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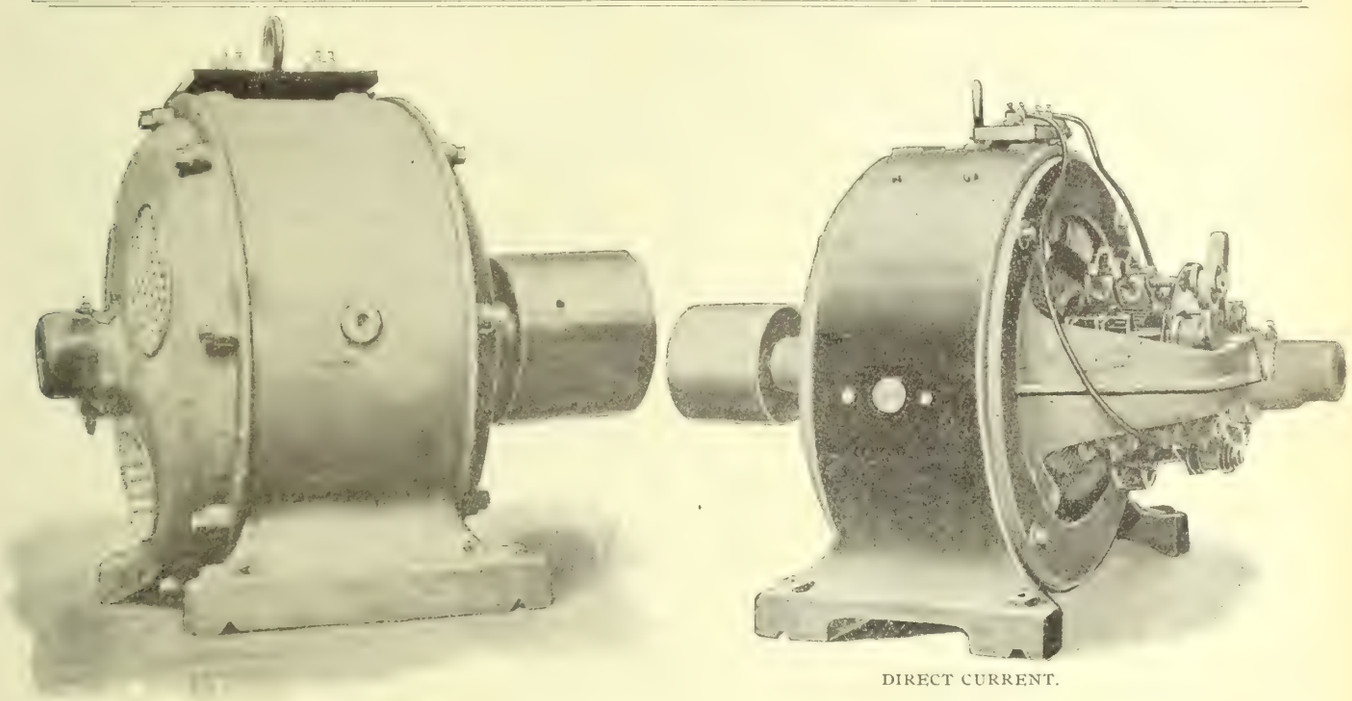
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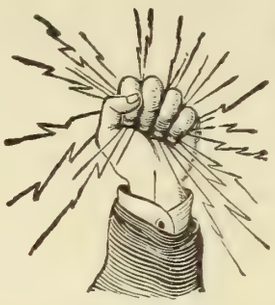
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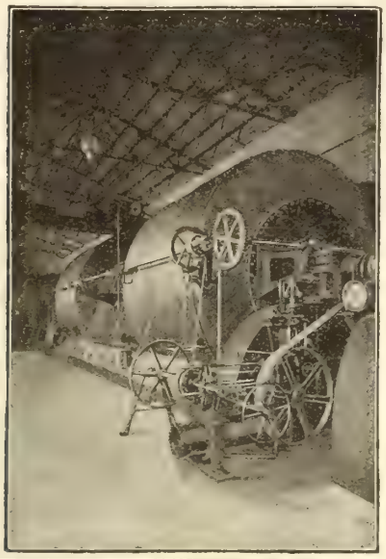
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WRITE FOR CATALOG. DEPARTMENTE E.

SPARKS.

Construction work has been commenced on the municipal telephone system for Port Arthur, Ont.

Mr. William Foley is suing the Toronto Street Railway Company for $10,000 damages for injuries received.

Mr. John Philips, of Grand Valley, Ont., is erecting a new power house and installing a new engine and boiler.

Messrs. Fitzgerald & Sauerman have disposed of the electric light plant at Watford, Ont., to Mr. Campbell McLeay.

The Electrisk Bureau of Christiana, Norway, submitted an offer to supply a municipal telephone system for Ottawa, Ont.

The Lachine Rapids Hydraulic & Land Company, of Montreal, will probably furnish light and power to St. Johns and Iberville.

The Eastern Telephone Company are considering the further extension of the telephone system through the Island of Cape Breton.

Mr. Roderick E. Burn, of 435 Lisgar street, Ottawa, has invented a conductor's fare box for which he claims the usual advantages.

The contract for the equipment of the Levi County Electric Railway at Levis, Que., has been secured by Messrs. Ahearn & Soper, of Ottawa.

The Ottawa Street Railway Company have purchased a large storage battery equipment from the Electric Storage Battery Company, of Philadelphia.

Messrs. Marcotte, Hardy & Pepin purpose constructing a telephone line between St. Raymond and Cap Sante, in the parish of St. Bazile, Que.

Mr. Thomas L. Chiles, of Akron, Ohio., representing Cleveland capitalists, is promoting a scheme to build an electric railway between Toronto and Hamilton.

The corporation of Parry Sound, Ont., wants applications for the position of superintendent of the electric plant, which is alternating and driven by water power.

The Hamilton, Grimsby & Beamsville Electric Railway Company are asking for tenders for the supply of 10,000 cedar railroad ties and 250 cedar trolley poles.

The Sherbrooke Gas & Electric Company and the Shebrooke Street Railway Company are reported to have been amalgamated, and it is said that the new corporation proposes also to secure control of the People's Telephone Company.

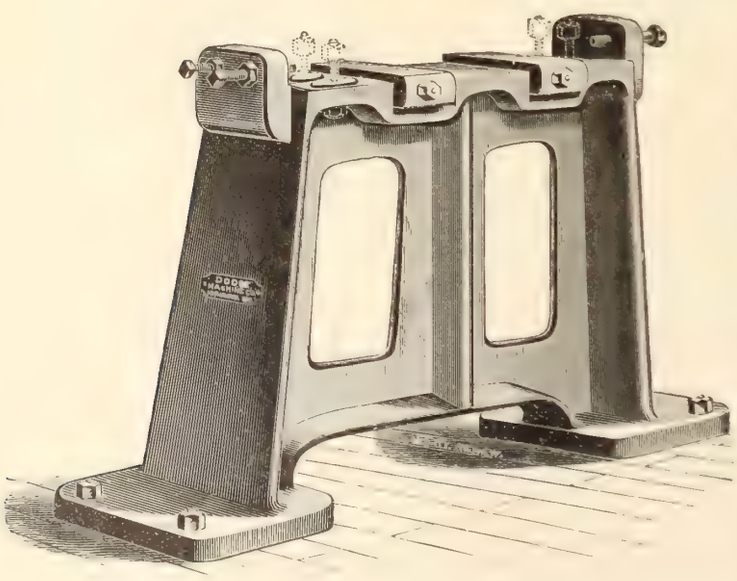
The corporation of Annapolis Royal, N. S., is about to extend the electric light plant. Tenders for extension and for construction of a dam, flume, power house, water wheel and draught tube are invited by Mr. F. W. Harris, town clerk, up to August 8th.

It is expected that the Windsor, Essex and Lake Shore Electric Railway will be completed by December, 1903. The contractors for the road are Seligman, Burke & Company, of New York, while Mr. A. J. Nelles, of Hamilton, has been one of the chief promoters. The road will be 45 miles in length.

The Jacques Cartier Power Company, of Quebec, have awarded the contract for the installation of the large water tube boilers and the necessary equipment, including steam pump, steel smoke stack and piping in connection thereto, to Mr. John J. Main, manager of the Canadian Heine Safety Boiler Co., Toronto. These boilers are to be of 500 h. p. each, and are to be placed in the company's new steam power house at the extremity of St. Sauveur. This plant, which is expected to be complete and ready for operation in a few months, will cost, including engines, in the vicinity of one hundred thousand dollars. It is to be constructed as a reserve steam plant and will be kept in perpetual readiness to be utilized should an interruption occur in the present hydraulic plant. The Heine Boiler Company are to be congratulated on having their boilers selected from among the many offered for this important plant, which is another testimonial to their great efficiency and economy. This company are to install the large boilers for the waterworks pumping station in Toronto, which contract was also secured after competition with several other boiler firms. The Heine Company are also installing another large boiler at the Toronto Electric Light Works, which have already in operation over 3000 h. p. of the "Heine," and are in correspondence with a number of other concerns with a view to future contracts. The Heine people seldom fail to "get there" if given half a chance.

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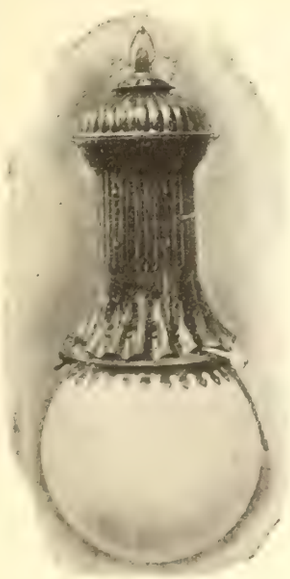
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In addition to the "Radiant Shelby" lamp made by this company during the past two years, they have patented a new spiral filament lamp, called the "Brilliant," which they claim bids fair to revolutionize the lamp business, giving nearly double the amount of light from the bottom of the lamp without consuming any additional current.

Mr. Walter Grose, Montreal, selling agent for this company, will be pleased to give any information regarding either the "Brilliant" or the "Radiant Shelby" lamp, and solicits sample orders from large lighting stations and dealers in electrical supplies.

This company will also manufacture a line of sockets, reflectors, etc., in the near future, in addition to the extensive line of lanterns, lamps, lamp burners and light producing specialties which they have been manufacturing for the past fifteen years.

THE VANCOUVER POWER DEVELOPMENT.

Further steps towards the development of the water power at Coquitlam Lake by the Vancouver Power Company have been taken by the awarding of the contract for the construction of a tunnel through the mountain from Lake Beautiful to Lake Coquitlam. The length is 13,000 feet, and the contractors are Ironsides, Rannie & Campbell. The tunnel will cost $250,000 and will require over two years to complete.

The development of this power is one of the largest undertakings of the kind ever commenced in Canada, the estimated cost being $1,250,000. The hydraulic engineers are Messrs. Hermon & Burwell, who are assisted by Mr. W. Meredith, of San Francisco. The water of Lake Coquitlam will be piped through the tunnel under the mountain separating the two lakes. This mountain rises above the tunnel to a height of 4,000 feet. The power will be utilized for supplying light and power in the cities of Vancouver, New Westminster and Victoria and in operating the railway of the British Columbia Electric Railway Company.

MOONLIGHT SCHEDULE FOR SEPTEMBER.

Day of Month.	Light.		Extinguish.		No. of Hours
		H.M.		H.M.	H.M.
1....	P.M.	7.00	P.M.	4.30	9.30
2....	"	7.00	"	4.30	9.30
3....	"	7.00	"	4.30	9.30
4....	"	7.00	"	4.30	9.30
5....	"	7.00	"	4.30	9.30
6....	"	7.00	"	4.45	9.45
7....	"	7.00	"	4.45	9.45
8....	"	8.40	"	4.45	8.05
9....	"	9.30	"	4.45	7.15
10....	"	10.10	"	4.45	6.35
11....	"	11.00	"	4.45	5.45
13....	"	0.00	"	4.45	4.45
14....	"	1.00	"	5.00	4.00
15....	"	2.00	"	5.00	3.00
16....	No Light.		No Light.		
17 ...	"		"		
18....	"		"		
19....	A.M.	6.30	A.M.	8.30	2.00
20....	"	6.30	"	9.15	2.45
21....	"	6.30	"	10.00	3.30
22....	"	6.30	"	10.50	4.20
23....	"	6.20	"	11.45	5.25
24....	"	6.20	"	0.45	6.25
25....	"	6.20	"	1.45	7.25
26....	"	6.20	"	3.00	8.40
27....	"	6.20	"	4.00	9.40
28....	"	6.15	"	5.15	11.00
29....	"	6.15	"	5.15	11.00
30....	"	6.15	"	5.15	11.00
Oct. 1.	"	6.15	"	5.15	11.00
			Total		189.35

The power house of the Mattawa Electric Company at Mattawa, Ont., recently suffered damage by fire.

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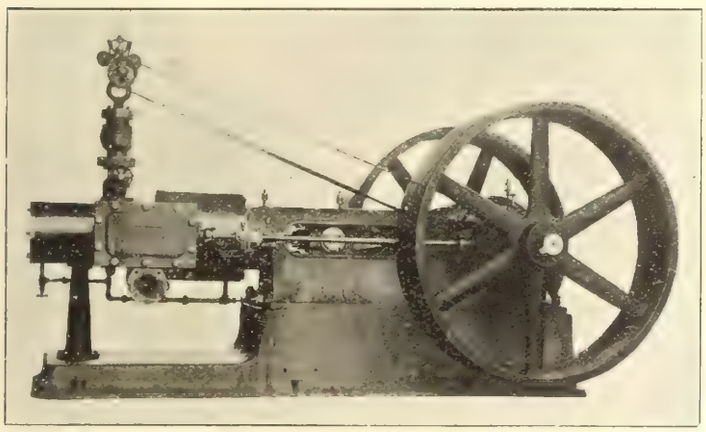
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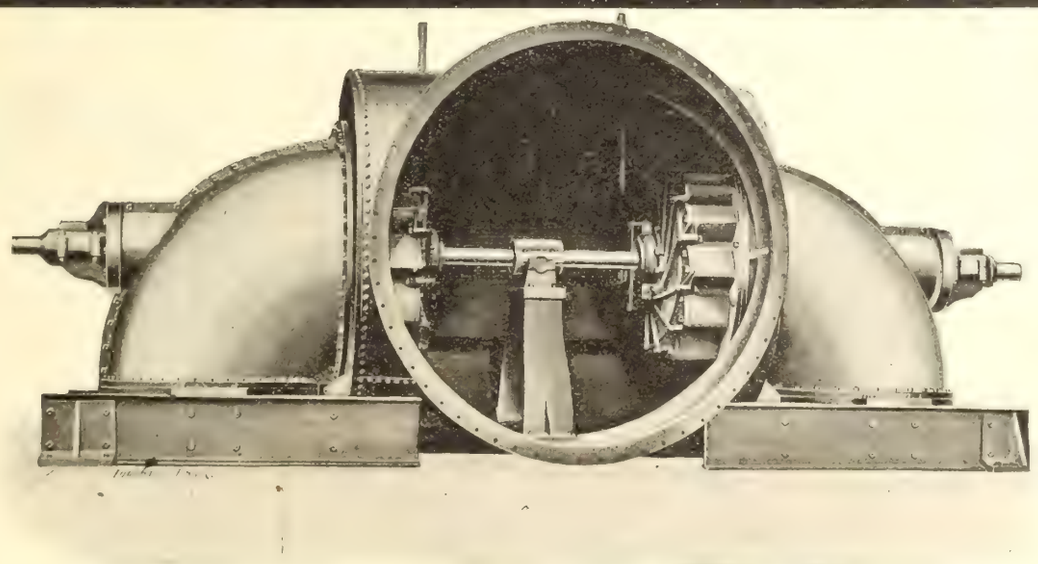
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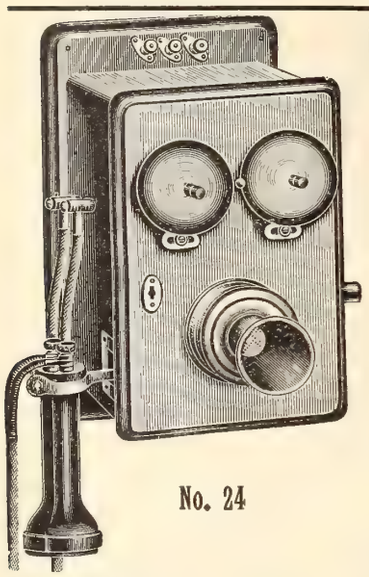
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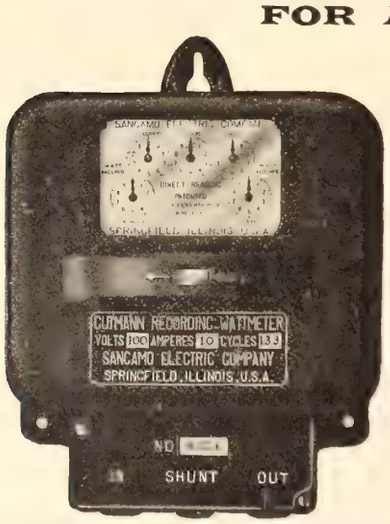
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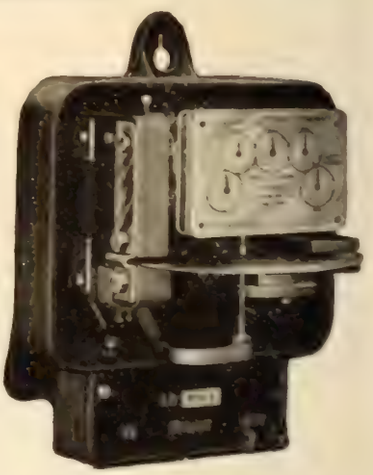
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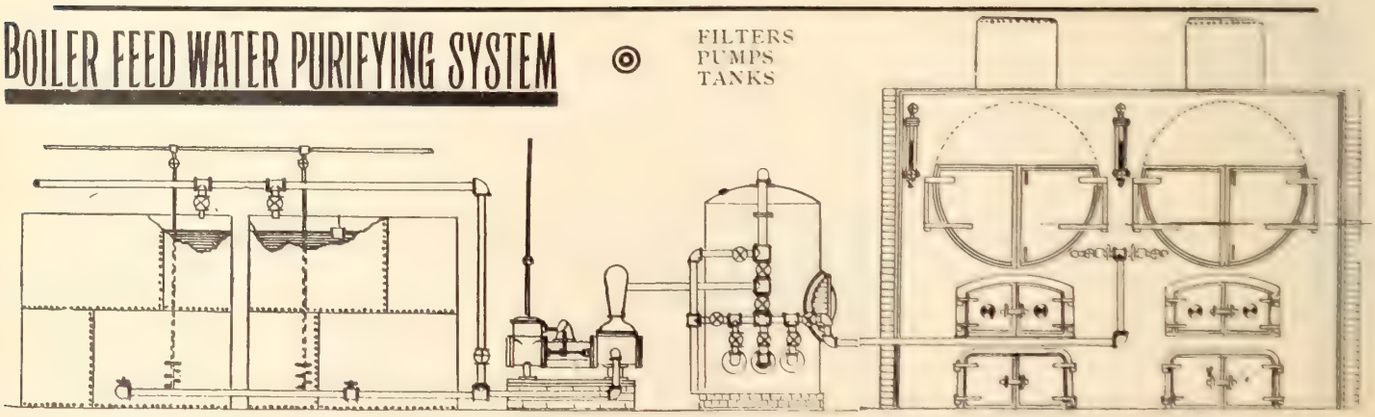
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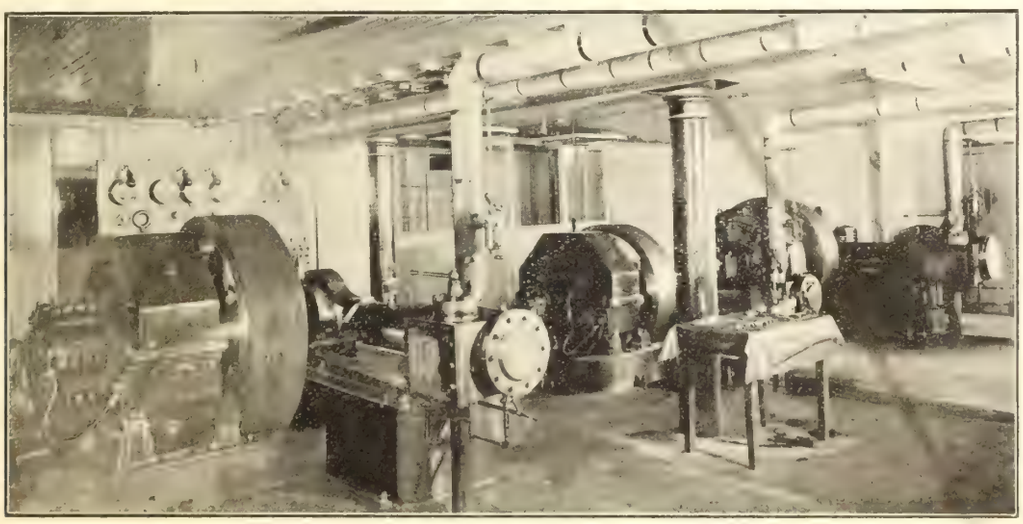
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CANADIAN
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AND
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VOL. XII. AUGUST, 1902 No. 8.

ELECTRIC PLANT FOR THE HUDSON'S BAY STORES.

Prior to 1899 the Hudson's Bay Stores in Winnipeg were lighted exclusively by gas, but in that year a large addition was made to the building and an isolated electric plant was installed. This was put into use first in May, 1900, and at that time there were in operation two high speed engines direct connected to the dynamos. The former are of the Robb-Armstrong side-crank type and are of 60 and 30 h.p. respectively. The dynamos were furnished by the Western Electric Company, of Chicago, and are 40 and 20 k.w. capacity respectively. With the extension



ELECTRIC PLANT IN THE HUDSON'S BAY STORES, WINNIPEG, MAN.

of the business it was found that these engines and generators were not sufficient to supply all the current required, and another 60 h.p. engine and 45 k.w. dynamo of the same makes as the others were added in 1901.

All the main departments of the stores are lighted by incandescent arc lamps, there being sixty of these in use, besides many hundreds of the ordinary 16 c.p. incandescent lights. The sewing machines and pressing irons in the tailoring and dress-making departments are operated by electricity generated by this plant, as are also the motors for driving the cash system throughout the stores.

There are one Robb 100 h.p. boiler and two Leonard 75 h.p. boilers, which, in addition to heating the building and driving the engines and generators, furnish the power for the pumps used in connection with the several elevators in the building.

SUCCESSFUL STUDENTS.

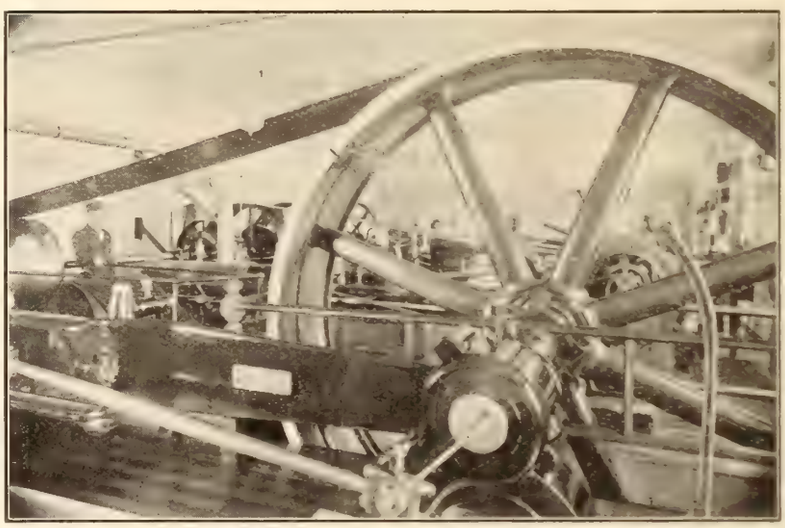
The following students were successful in the mechanical and electrical course at the spring examinations of the School of Practical Science, Toronto :

Honors—First Year—J. H. Barrett, S. E. Craig, W. S. Gibson, C. P. McGibbon, A. E. Pickering, M. R. Riddell, R. S. Smart, S. E. Thomson. Second Year—J. H. Alexander, H. H. Angus, F. A. Gaby, C. A. Maus, M. L. Miller, D. K. Pinkney, H. M. Shipe, H. G. Smith, S. B. Wass. Third Year—H. G. Barber, R. J. Dunlop, C. H. Marrs, D. Sinclair, T. Taylor.

Pass—First Year—H. E. Beatty, J. C. Boeckh, R. J. Burley, F. W. Burnham, J. W. Calder, A. M. Campbell, W. M. Currie, W. K. Greenwood, C. J. Harris, T. D. Henderson, P. V. Jermyn, J. W. Johnston, W. S. H. Keefe, A. H. Legge, O. B. McCuaig, C. D. McKay, C. J. Manson, E. E. Moore, W. H. Munro, J. J. O'Sullivan, C. Pace, W. S. Pardoe, W. J. Peaker, G. S. Roxburgh, F. N. Rutherford, P. M. Sauder, F. W. Slater, W. J. Smither, C. J. Townsend, B. B. Tucker, J.B. Watson, W. F. Wright, P. M. Yeates. Second Year—H. G. Acres, J. A. Beatty, A. E. Davison, C. J. Fenson, J. G. Jackson, C. K. Johnston, A. G. Lang, W. J. Larkworthy, J. A. McFarlane, P. H. Mitchell, E. E. Mullins, J. P. Oliver, J. D. Pace, B. B. Patten, R. B. Ross, H. S. Small, S. L. Trees, J. A. Whelihan, H. F. White. Third Year—J. M. Brown, W. Elwell, A. C. Godwin, C. Henwood, D. M. Johnston, A. H. McBride, J. T. Mackay, J. F. S. Madden, P. Mathison, R. S. Mennie, H. D. Robertson, W. H. Sutherland, A. A. Wanless, H. Zahn.

THE CENTRAL ELECTRIC COMPANY.

One of the first electric companies to be established in Manitoba was the Central Electric Company, Limited, of Portage la Prairie. This company was formed in 1890, since which time its business has gradually increased. The power house is a frame structure 67 x 68 feet, on a stone foundation. The engine room is 33x67 feet and the boiler room 35 x 67 feet. The first boiler installed was one of Goldie & McCulloch's make, 54 inches diameter by 14 feet. This boiler was reset two years ago, at which time the boiler capacity was increased by two Leonard boilers, single sheet, 72 inches diameter and 16 feet long, of 150 h.p. each, tested to 200 pounds cold water pressure. The boilers are bricked in with outer wall of three bricks thick, then a three-inch air space and then an inner wall of two bricks thick, lined with fire-brick up to the lugs. This method of construction has been found very satisfactory and to well repay the cost. The smoke-stack is 75 feet high and 42 inches in diameter, 60 feet of which is of heavy iron on a 15-foot brick base, the smoke-box connecting same with the boiler. The boilers are fed by column pumps and there is also a duplex steam pump as an auxiliary which can be used either for feed or for fire protection. Usually about 125 pounds of steam are carried.



Central Electric Company, Portage La Prairie, Man. Engine Room.

A Wheelock cross compound, condensing engine, furnished by the Goldie & McCulloch Company, of Galt, was at first installed. The pressure cylinder is 13x34, low pressure cylinder 24x34, and fly wheel 12 feet diameter and operating at 92 revolutions. This engine has been in contniuous use since installed. Two years ago, on account of increased load, it was decided to put in a Brown engine, single cylinder 13x34, with fly wheel 11.6 feet, operating at 92 revolutions. This engine is only used for a few hours daily during the heavy load in winter time.

The dynamo plant consists of one 75 k.w. and one 40 k.w. National machine put in at the original installation, and one 150 k.w. S.K.C. machine, with marble switch-board and instruments complete. The latter machine was installed two years ago and has given perfect satisfaction.

The officers of the Central Electric Company are: President, Robert Watson; vice-president, Jos. Martin; secretary-treasurer, D. B. Hanna. The management of the plant is in the hands of Mr. J. W. Clayton.

The town of Campbellton, N. B., have purchased one 175 h. p. Robb-Armstrong automatic engine and one 175 h.p. Mumford standard boiler from the Robb Engineering Company, Amherst, N.S.

LEVIS COUNTY RAILWAY COMPANY.

Progress on the new electric railway in Levis, St. Joseph, Bienville and St. Romuald, the town across the St. Lawrence River from Quebec, goes steadly forward. The mortgage, or deed of trust, to the New York Security and Trust Company was recently recorded at the Levis Registry office.

The car barn of the company is situated on Fraser Street, and is in full view of the Terrace in Quebec. It is a very pretty and substantial structure, with brick walls and wooden roof. The two pointed towers on the front face the river and are each to be surmounted by a flag-staff. This building at present is receiving its roof.

The brick sub-station building was completed several weeks ago, and on July 17th the machinery foundations and the cement floor were finished. The switchboard was shipped by the Bullock Electric Manufacturing Company, of Cincinnati, Ohio, and was received about the twenty-fifth of July. The motor-generators are to follow in two weeks. Power at 10,000 volts has been contracted for with the Canadian Electric Light Company. There is a mile and a half of street trenched, and with the ties laid, stands ready to receive the steel rails which are being shipped from Sault Ste. Marie. The ties are distributed along the greater part of the streets. There are five miles of poles erected. All the overhead material has arrived and will be put in place as soon as the rails are laid. The private telephone system is completed and in operation.

The cars and equipment will be ready about the time the rest of the construction is finished, which will be about the end of August. A 350 feet trestle is being built at one part of the line and the piers for reception of a sixty-five foot steel bridge across the river will be ready early in August.

The electric elevator up the side of the cliff, opposite the Intercolonial Railway Station, is in the hands of the Fensom Elevator Works, of Toronto. The face of the cliff where it is to be located has been grubbed and cleared for reception of the steel work. Altogether, the outlook is most promising that the Levis County Railway will be running before Fall.

The Weston Electric Company, Chicago, through their Canadian agent, E. Irving, Toronto, have secured the contract for the installation of a new series alternating arc light system for the city of Brockville. The installation consists of one 50-light equipment and one 25 light equipment, including lamps, automatic regulators, air cooled transformers and marble switchboards.

QUESTIONS AND ANSWERS

"R. L.," London: We are running a Wheelock engine which is sometimes overloaded so that the governor does not trip the steam valve; will this hurt it? What shall we do to overcome it?

Ans.: The fact that your engine takes steam all through the stroke, which is the case when the governor does not trip the valve, will not of necessity hurt the engine, though it is an indication of a severe overload which is going to give trouble from straining the various parts, such as main bearing, crank pin, etc., which as a rule are not designed to stand such heavy duty for any extended period. The proper remedy is to put in a larger engine; if you cannot reduce the load, perhaps it might be possible to change some of your pulleys, which, while keeping the shafting speed the same, would allow you to speed up the engine. This, with the increased steam pressure, might help matters somewhat.

"Electrician": Would you please advise me what is the best way to arrange my switches when connecting together two compound wound dynamos, first, to run a three wire service, and second, in parallel.

Ans.: For a three wire plant you will need two double pole switches, one for each machine, and what is called a break-down switch, which is triple pole triple throw, wired to the lines so as to connect them three wire onto both machines when thrown one way, and two wire onto one or the other of the generators according to which of the remaining positions it is placed in. This allows you to stop one machine if desired either for repairs or inspection or to save steam, and still operate part of your lamps or of those motors connected between either outside wire and the neutral; those connected across the two outsides cannot be operated. If you desire to lessen the original cost as much as possible, you can leave out this break-down switch, in which case you can slightly simplify and cheapen your main generator switch equipment by putting in one triple pole instead of the two double pole. You will note that in a 2 generator 3 wire system, the machines never being in parallel, there is no need to provide for any equalizer connection. For running a parallel you can use two triple pole switches or else two double pole and two single pole; in the former case you must of necessity close positive, negative and equalizer connections simultaneously; in the latter by wiring the positive and equalizer to the double pole switch, and the negative to the single pole, you get the effect of the series winding in the machine being thrown in before its armature is connected to the circuit. By this means you are able to put the second machine in with less disturbance to the line voltage, which is sometimes very marked if the triple pole system be used, especially if the machines are heavily compounded. An exception to the above is sometimes made in the case of large machines, especially when of low voltage and situated some distance away from the switchboard, in which case the equalizer switches are placed on a pedestal one beside each machine; the equalizer bus bar running in as short a manner as possible, direct from generator to generator, and not going to the switchboard at all. Where the machines you are handling are a large size, it is sometimes considered desirable to make switches single pole, with or without barriers between them, this to prevent the chance of short circuiting when opened under heavy load, which is always present with a double pole switch to a greater or less extent. This change is irrespective of the service being two wire or three wire, and of the number of generators.

"Student," Montreal: What is the difference between a recording and an indicating wattmeter.

Ans.: The recording meter, as its name indicates, records or registers the consumption for energy which has taken place since it was put into the circuit; deducting from the reading at any given instant the amount registered at the last time it was read gives you the amount of energy reckoned, in watt hours, consumed in the interval. You will note that a watt hour being the power represented by a consumption of one ampere of current, at a pressure of one volt, for a period of one hour, or any other value of any or all of these factors whose product is one, the instrument does not give any indication of what has been the maximum or minimum current or voltage, nor the number of hours during which power was used—it simply gives the product of the three factors directly in watt hours. The indicating watt meter is like the ordinary ammeter, only instead of showing the number of amperes on the machine or circuit to which it is attached, it takes into account the voltage as well, and reads the number of watts being consumed at any given instant. Both instruments have this in common, that, when connected to alternating current circuits, they take account of the power factor, and record the true watts, not the volt-amperes; the former is less than the latter if the power factor of the circuit varies from unity.

"Enquirer": Would you kindly tell me the difference in loss of power factor for lighting purposes between a 133 cycle and 66 cycle generator, if it takes much more power on the water wheels, which is the power we use. The power is in the centre of our business extending about two miles either way. I wish to put in a few motors, and would be pleased to get all the information possible before doing so as to the loss in the different cycles of machines. I may say we have the 133 cycle generators now in use and quite a few motors. So would not wish to change unless there is quite an advantage; our business is mostly light. The time was so limited at the convention that such questions as above would not have been noticed as being too simple for such topics as came up.

Ans.: The difference in the power factors of a 133 and a 66 cycle lighting system is not of any practical or commercial importance; theoretically the latter will have a somewhat higher power factor and a somewhat less line drop, other conditions being equal, but except in extremely large plants the differences would not be large enough to be material. There is one point, however, that it may pay you to look into, and that is, that the transformers for the lower periodicity will usually cost more than the others. If you are considering the installation of motors the matter is different, as there are but few makers who have a 133 cycle motor to offer, and then only in a very limited range of sizes. It is to be regretted that at the recent convention in Quebec the time for the discussion of subjects like this was very limited, but we must differ from your statement that they would not have been noticed; they are very much to the point and would have afforded profitable ground for discussion.

"R.H.," Hamilton: I have a number of transformers on hand off a multiple arc system. They are S. K. C. 1000 watt, 1000 volt to 50 volt. Can I use them on the incandescent circuit by putting them on the same pole and connecting the secondaries in series? Our system is 1040 volt primary, 104 v. secondary.

Ans.: Yes, these 1000 to 50 volt transformers can be used in pairs this way, the primaries in parallel and the secondaries in series, to give a 100 or 104 volt secondary, without any difficulty.

CANADIAN ELECTRICAL NEWS AND ENGINEERING JOURNAL

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Correspondence is invited upon all topics coming legitimately within the scope of this journal.

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Reduced Price for Current

THE action of the New York Edison Company in reducing the price of electric current has a peculiar interest for all central stations, for upon the price at which current can be profitably sold will depend in large measure the expansion of the electrical industry. The reduction in question applies to arc and incandescent lighting, and is from a maximum price of 20 cents per kilowatt hour to 15 cents, or 25 per cent. The new schedule is as follows: 15 cents for first and second hours; 10 cents for third and fourth hours; 7½ cents for fifth and sixth hours; 5 cents over six hours. It is estimated that the average charge under the old rates was about 10.5 cents per kilowatt hour, so that an average of about 8 cents should be reached under the new scale. This price should greatly encourage the use of the electric light. Coming at a time when nearly everything else is advancing in price, the reduction will doubtless be the more highly appreciated by the consumers.

Steam vs. Water Power.

THE proposed installation of steam plants by one or two Canadian electrical companies heretofore using water power exclusively has revived interest as to which class of power is most satisfactory. In one instance it would seem to have been decided to provide the required power by a steam plant rather than by increasing the water power installation, which was at one time under consideration. There are still to be found advocates of steam power, especially for lighting purposes. While for motors water power is almost universally satisfactory, as much cannot be said for lighting, owing to the difficulty of securing perfect regulation and the serious results consequent upon a shut-down. The defect in regulation is usually attributed to the turbine, the governor not being capable of preventing the fluctuations. It has been suggested that something might be done to overcome the difficulty by placing a regulator on the alternator, so that only a certain amount of current would pass into the fields. Another point in favor of steam plants is their greater reliability, especially when compared with water power where the current is transmitted over a great distance. With the latter the danger of accident applies to the power house, transformer station and pole line. These are some of the reasons why leading electricians are not unanimously agreed that it will be found profitable to transmit Niagara power to Toronto.

Telephone Competition.

THE city council of Spokane, Washington, has refused a competitive telephone franchise to a local company. The decision was reached after exhaustive inquiries from other cities in the United States, and following the presentation of a petition from telephone subscribers, representing six hundred telephones, protesting against a dual system. A very strong letter on the subject was received from Mr. George M. Hoag, city electrician of Cleveland. He characterizes the experiment of competition in the telephone business in that city as a public calamity, claiming that over five thousand subscribers have instruments from both companies. The results are briefly summarized by him as follows: "The streets are encumbered with many poles that would be unnecessary if we had only one company; the present users of telephones are paying probably $175,-

000 or $200,000 per year more in rentals than they would with one system. There is the inconvenience of looking through two directories instead of one to find subscribers' names; many small investors and some larger ones have made investments which have not up to the present time proved desirable, resulting in unpleasant combinations much to be regretted." While there is much to be said both for and against competition, the peculiar nature of the telephone business places it in the class where competition is not desirable. It is much better to aim to so control existing companies that the public will be amply protected than to encourage the organization of opposition concerns.

Electric Fires.

THE danger of fire resulting from electric wires has been so grossly exaggerated by the press that the Insurance and Finance Chronicle, of Montreal, takes up the defensive side of the question as follows: "Electricity is experiencing the tendency of mankind to make anything a scape-goat that is available and cannot retaliate. Mysterious fires nowadays are commonly attributed to electricity, just as in earlier days all manner of mysterious visitations of sickness, accident and other calamities were attributed to witchcraft. The poor witches, so-called, could not prove their innocence, so neither can electricity, so it is being charged with most fires whose origin is mystery. The Electrical Bureau of the U. S. National Board of Fire Underwriters have issued a report on electric fires in the last quarter and fires so classed without evidence. The report states that "Numerous fires reported as due to electricity have, upon further and more reliable investigation, been found to have been due to other causes. Of these a $65,000 loss was due to spontaneous combustion in a pile of hair and packing material. A loss of $165,000 occurred in the celluloid room of a factory as the result of overheating celluloid on a softening press. A $4,000 loss resulted by overturning a candle while storing away goods. An $18,000 loss in a hotel was attributed to a defective flue. Other fires attributed to electricity were found to be due to an overheated smokestack, a leaky gasoline lamp, spontaneous combustion in oiled canvas, a gas heater, burning shellac in a bake oven, and an overheated furnace pipe. Reports were received from inspection departments aggregating $1,601,047, supposed to be due to electricity, but they are not included in this report, as the causes could not be definitely proven as electrical, principally because the fires destroyed the conclusive evidence of their origin."

The corporation of Durham, Ont., may install an electric light plant.

The ratepayers of Milton, Ont., defeated the by-law to purchase the electric light plant.

The sales of Westinghouse transformers have more than doubled in the past six months, and the transformer building capacity of the Westinghouse Company has been largely increased to meet the demand for O. D. and Type "N" Transformers.

SIMPLE HOTEL TELEPHONE SYSTEM.

Mr. Percy M. Brown, of Toronto, sends to the American Electrician the accompanying diagram representing a simple telephone system adapted for operation in connection with single-call hotel annunciators, concerning which he says:

The system is the central-energy system, but in order to simplify the apparatus and circuits, separate batteries are used for ringing and talking. The talking battery has a common-return wire extending to all of the stations, and the gas or water pipe system of the building is used as a return for the ringing battery. The diagram represents circuits for six stations or rooms, the instruments for these being indicated at the right-hand side of the engraving. In all cases T indicates a transmitter and R a receiver.

The switchboard arrangement is extremely simple, consisting of a single connection plug at each end of each cord circuit, and a one-spring jack for each station. The diagram shows the connections for a single-cord circuit and the central operator's set. A combined listening and ringing key of the rocking or oscillating type, similar to those in general use, is employed. The key is thrown to the left, as stated in the engraving, for ringing, and to the right for listening in. Each circuit, of course, has a ringing and listening key and choke coil, one terminal of every choke coil being connected to the talking battery wire, b. The operation is as follows:

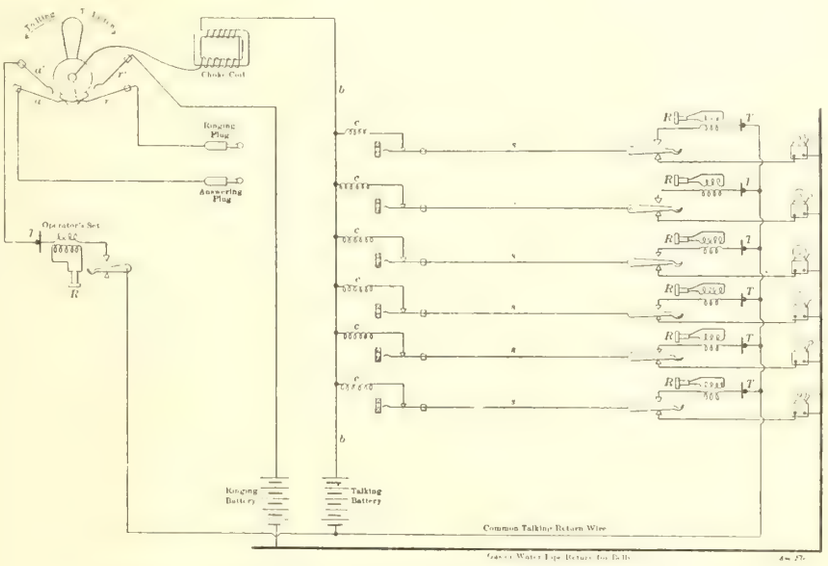


DIAGRAM OF CONNECTIONS FOR SIMPLE HOTEL TELEPHONE SYSTEM.

In order to call up a room, the central operator inserts the ringing plug in the proper jack, pushing the jack spring away from its contact and thereby disconnecting the service wire, s, from the coil c, which is connected to the talking battery wire, and at the same time connecting the service wire, s, to the ringing spring, r, on the ringing and listening key. Throwing the key to the left then connects the wire, s, of the desired station to the ringing battery through the springs, r and r^1, and rings the bell in the distant room. Then reversing the position of the operator's key and substituting the answering plug for the ringing plug in the jack puts the central telephone set in connection with the called station. Removal of the receiver at that station allows the hook-switch to change the connection from the bell to the transmitter circuit, as usual, and conversation is then carried on by means of the common talking battery. When two stations are talking to each other, they are connected in the usual fashion by the two plugs of a cord circuit and the springs, r and a, on the operator's key; the metal segment on the key, which forms a bridge between the two springs, is connected to one terminal of the choke coil. This is necessary in order to permit the use of a common talking battery.

The system is open to the disadvantage that the central operator after calling up a station cannot listen in except by reversing the ringing key and changing the plugs in the jack, but as telephone service in a hotel of ordinary size is not heavy, this is not serious; no difficulty has been experienced on this account with an experimental installation recently put in by the writer. A convenient feature lies in the fact that by throwing any ringing and listening key to the left without inserting any plugs in the jacks, the bells of every room will be rung simultaneously, as this connects the ringing battery through the choke coil to the wire, b b, which is in connection with all the individual service wires through the coils, c, and the jack springs. This feature permits a fire alarm signal to be transmitted to all of the rooms without any manipulation other than the simple throwing over of one ringing key.

LIGHTNING PROTECTION AND THE STATIC INTERRUPTER.*

By Mr. Percy H. Thomas.

It has sometimes been stated that everything in nature somehow or other serves a useful purpose. It may be, however, somewhat difficult for practical electrical men to see much of use in lightning. They usually much more clearly realize the damage and inconvenience which it causes them; but, however this may be, we cannot alter the conditions, and lightning must be forestalled. The problem is certainly a very difficult one, for sensitive apparatus is to be protected from extremely violent disturbances, greatly exceeding in tension the normal strains which are contemplated in the design of the apparatus; and, furthermore, protection must be secured without interrupting the normal operation of the system. It is necessary to separate the extremely high tension electric energy of lightning from the useful current at the moderate voltages of commercial circuits. Fortunately this may be accomplished with nearly complete success. It must be frankly confessed, however, that occasionally damage will result even with the very best available protection.

A stroke of lightning from the clouds usually follows some clearly defined path or paths in its discharge, causing violent destruction of nearly everything in its way; and in addition to this local violence, it also electrically disturbs the whole neighborhood. Like the cannon ball, which causes a great commotion in the air for some distance around as it passes, so lightning stirs up every electrical conductor within a considerable distance, causing a tendency for it to spark to other objects. Fortunately, in commercial lighting and power circuits, it is usually only these induced or secondary effects with which we have to deal, for lightning rarely strikes a line directly. The western cyclone is supposed to take up light bodies, such as straws, and give them such high velocity that they are able to penetrate boards. The secondary effects of lightning, which are in the form of waves occurring both in the ether and in all exposed wires, have some of the characteristics of these straws. They represent a comparatively small amount of energy, but are very sudden or abrupt in their nature, and produce extremely severe local con-

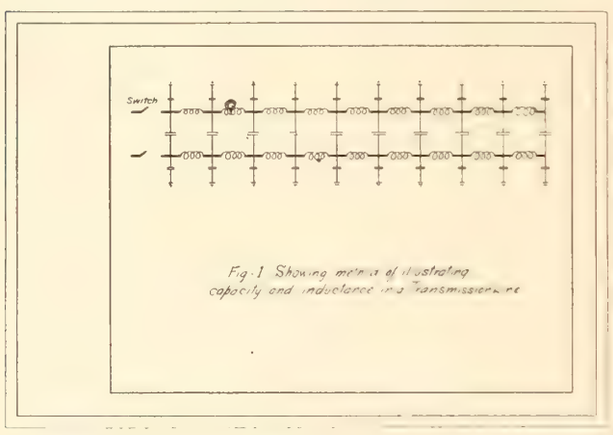


Fig. 1 Showing method of illustrating capacity and inductance in a transmission line

centration of strain. One of these secondary electrical waves passing along a straight wire makes comparatively little demonstration, as it meets little opposition; but if this wave finds a coil in its path, rather than flow around the turns of the winding, it will produce a strong tendency to jump across. Such waves have all the characteristics of the discharges obtained from frictional machines, and together with all other disturbances of a similar nature which occur in commercial circuits, may be defined as "static." An outline of the more common causes of static waves will be given in another part of the paper.

GROUND AND SHORT CIRCUITS.

Experience has shown that the injuries to electrical apparatus caused by lightning are generally of two sorts — First, "grounds," caused by the passage of sparks to earth, and, second, "short circuits," caused by the jumping of electricity between the turns of coils. All persons who have had much dealing with electrical apparatus are familiar with the thought of a "ground" resulting from lightning, since lightning is supposed at all times to seek the earth. In fact, the "ground" is older than the lightning arrester; but many do not recognize the fact that lightning may cause short circuits between turns of coils, as well as "grounds," even when not passing to earth. Such a possibility is shown by short circuits appearing in coils of a generator or transformer in such a location as to make it practically certain that no electricity has passed to earth. The explanation of the manner in which short circuits are caused and the description of a new type of apparatus devised by the writer to protect against such short circuits, form the principal object of the present paper.

ELECTRO-STATIC CAPACITY IN HIGH TENSION APPARATUS.

This power of lightning disturbances to cause short circuits arises in the fact that all parts of an electric system, including the generator and transformer winding, lines, instruments, etc., are to some extent electro-static condensers, and consequently before any part of the system can be raised to a particular potential, it must receive a charge proportional to this potential.

A high tension transformer coil has, comparatively speaking, quite a large electro-static capacity, since it has a considerable surface exposed to the low tension coils and to the core, and since it is separated from them only by a thin wall of insulating material. This capacity is greater the thinner the insulation between high tension and low tension coils and the greater the area of the surface of the copper. Similarly with generator coils, and in fact all kinds of apparatus.

Consider the charging of a high tension coil in a transformer when the voltage is being slowly raised. Each turn of the coil adjacent to the low tension winding, or the core, on account of its electro-static capacity subtracts a certain amount of electricity from the current which is passing, to form its charge. As the voltage rises, each turn continues to absorb the charge so that the current at the end of the coil farthest from the generator is less than that at the nearer end, since some electricity is abstracted at each turn. The amount of electricity thus withdrawn from the useful current is in commercial circuits usually very small in amount except on high voltage systems. In such systems the charging current, which flows to an open circuited line from the bus-bars, simply represents the sum of these small charges. In the case of the transmission system the line wires require nearly all of this charging current, leaving a small amount only for the transformers and other apparatus.

On the other hand, when the voltage of the circuit is gradually falling to O, all the electricity that has been stored in the electro-static capacity of the various parts of the system is given back to the circuit and the load current increased somewhat. The amount of these small charges on the line and apparatus, in other words, the charging current, depends solely upon the voltage of the circuit, and not upon the actual load current flowing. The total current in the line at any instant is the sum of the current taken by the receiving apparatus at the sub-station and the charging current.

LOCAL CONCENTRATION OF POTENTIAL.

Let us consider further the case of raising the voltage on a high tension coil, either of a transformer, generator or motor. As already stated, each turn on the surface of the coil must have its own charge, but the charges for the turns farthest from the source of current will arrive at their destination last, since they must flow through the other turns of the coil. Since a certain amount of time is required for the passage of the current around these turns, if the voltage be raised very quickly, the more remote parts of the winding will be charged up somewhat later than the nearest.

To make these explanations clearer, we may compare the coil to a long rubber tube wound up like the coil and filled with water, the whole being immersed in a tank of water. If, now, a current of water be started in the tube, no change occurs in its dimensions as long as the pressure within remains the same as the pressure outside, but if the pressure within the tube (which corresponds to the high tension voltage) be increased over that in the external liquid (whose pressure corresponds to earth's potential) the tube stretches to a certain extent and a certain amount of water is withdrawn from the current passing to fill the increased space (this corresponds to the electric charge absorbed by the wire with an increasing voltage). If the internal pressure be removed from the tube, it will contract and the water which had been originally withdrawn from the current flowing when the tube was distended will now be returned exactly as the stored electric charge is restored to the circuit when the voltage is removed.

To return to the effects of lightning. As already described, the result of a lightning stroke occurring near a line, which it does not, however, actually strike, is to cause waves of static electricity to pass along the line in both directions. These electric waves are extremely abrupt and travel with nearly the speed of light, that is, about 186,000 miles per second. When one of these waves passing along a wire reaches a lightning arrester, it usually causes the arrester to discharge by momentarily raising the potential of the line. If the lightning arrester be adequate it will prevent a serious rise of potential above the earth and will protect the apparatus from grounding. Suppose, however, for a moment, that there is no lightning arrester on the line, and that the apparatus connected is so perfectly insulated from the ground that no electricity passes to earth

* Paper presented at the Canadian Electrical Association Convention, Quebec, June 1902.

Under these conditions, when the wave reaches the machine or transformer coil, the potential of the terminal of the coil will be very suddenly raised; but on account of the inductance of the coil (which corresponds to the inertia of the water in the tube of our illustration) for an instant no electricity can flow to the inner turns of the coil to charge them. Consequently, for this instant, until the inertia of the coil, so to speak, is overcome, a large difference of potential exists between the terminal of the coil and the inner layers. This strain may be a great many times larger than the normal electro-motive-force impressed on these turns by the generator, and will then have a very strong tendency to break down the insulation between the turns. If such a break does occur and a spark passes through or over the insulation between the inner and outer coils, the static wave causes only sufficient electricity to pass to charge up the electro-static capacity of the inner turns This in itself will cause only a very small spark nearly, or quite invisible to the eye, but if it occur at a moment when there is a considerable electro-motive-force impressed upon the coil by the generator, the momentary breaking down of the insulation may start a permanent arc, which will be maintained by the power of the generator. This phenomena is very similar to the starting of an arc in the gaps of the lightning arrester by the static discharge from the line.

It must be remembered that a static spark between turns of the transformer or generator coil does not by any means necessarily cause a short circuit; for if such a spark occur at a time when the generator E.M.F. is near its zero point, no arc will follow: in fact, usually the generator is not able to maintain an arc across a few turns, as their voltage is comparatively small. Other conditions, as well, may prevent a short circuit. Many repetitions of the static spark in the same spot, however, even without current from the generator, will cause a deterioration of the insulation, and a short circuit may result subsequently as a consequence of this injury. In such a case the short circuit will very likely occur at some time other than that of a lightning discharge.

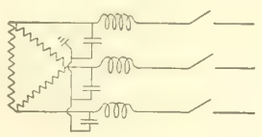
The characteristic of the static waves produced by lightning, which gives them power to puncture insulation between turns, is their abruptness, for the more suddenly the potential of the terminal of the coil is raised, the shorter the distance to which electricity will have penetrated to charge up turns when the maximum voltage at the terminal is reached, and the fewer the turns of the coil upon which this voltage will be impressed. If the terminal of the coil be raised or lowered slowly, comparatively speaking, as by the generator in its normal operation, no appreciable strain is produced.

Fortunately, every thunder storm does not cause internal static sparking in apparatus in every plant, with consequent short circuits for protective apparatus, is usually quite effective, but in all cases where such protection is not provided, strains on the insulation will be produced as already described. Such strains may or may not cause injury, according to the strength of the insulation. With well-insulated apparatus on low voltages, there is little danger of a break-down, for experience has shown the necessity of providing a normal margin of safety between the turns of coils in transformers and generators (probably largely on account of difficulties that have previously resulted from static). In fact, the insulation between adjacent turns of a large high tension transformer whose normal difference of potential is perhaps 100 or 200 volts, will often fail to break down at 10,000 volts.

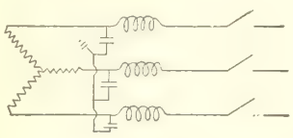
EFFECT OF DISCHARGE OF ARRESTER.

Up to this point, the question of the effect on the insulation of the coils of the discharge of an arrester to ground has not been considered. The primary function of the arrester is to discharge the line freely when the latter's potential rises abnormally. The most effective means for accomplishing this is, of course, the air gap, or series of air gaps between line and ground, but the arrester must as well prevent arcs being formed in the gaps by the generator after the discharge. The free discharge of the line can be best accomplished, except in special cases, by a series of non-arcing metal gaps, but as this type of arrester in operating practically reduces the line potential to zero instantly, the terminal of coils connected to the line will also be reduced to zero instantaneously, and the same sort of strain is produced as in the case of the secondary lightning wave, except that in these cases the terminal is suddenly dropped to zero potential instead of being raised. The difference in potential between the terminal and the inner layers is independent of whether the potential of the line is raised or lowered. Therefore, an arrester which is extremely free in its discharge of the line will successfully prevent strains to ground but may at the same time cause some strains between layers tending to cause some short circuit strains. Practically this matter becomes of importance only on high tension circuits.

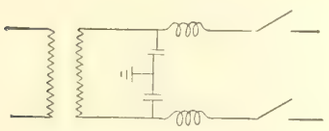
An arrester which does not ground the line quite as quickly, but is still able to prevent a serious rise of potential above the earth, is better for high voltage than one with a perfectly free discharge path. The use of series and shunt resistances in the "Low Equivalent" arrester, is for the purpose of attaining this result as well as increasing the non-arcing power of the arrester. Further discussion of the discharge of the line by an arrester, which involves some very interesting points, cannot be given in the limits of this paper. Before proceeding further, it will be well to summarize briefly.



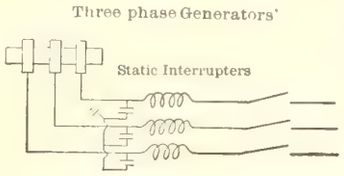
Three Static Interrupters Protecting Three Transformers Connected in Delta.



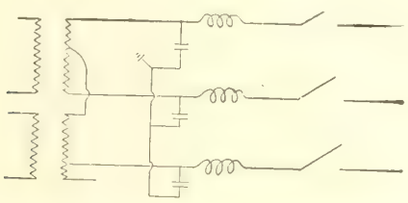
Three Static Interrupters Protecting Three Transformers Connected in Star.



Two Static Interrupters Protecting One Transformer.



Three Single Pole Static Interrupters Protecting a Three-phase Generator. Single-Phase and Two-Phase Generators are Protected by Two and Four Single Pole Static Interrupters Respectively, Connected In a Similar Manner.



Three Static Interrupters Protecting Two Transformers Connected for Three-phase High Tension and Two-Phase Low Tension Circuit

FIG. 2. -DIAGRAM SHOWING ARRANGEMENT OF STATIC INTERRUPTERS PROTECTING GENERATORS AND GROUPS OF TRANSFORMERS.

SUMMARY.

The most usual result of a lightning stroke in the neighborhood of an electric circuit is the production of secondary static waves traveling along this circuit away from the locality of the discharge. When one of these waves encounters a transformer or generator coil, it abruptly raises the potential of the terminal, and during the period while charging current is flowing to the inner turns of the winding, the potential of this wave will be impressed upon the outer turns alone, which may thus be subjected to a strain very many times greater than that normally impressed upon them. The harmful effect of

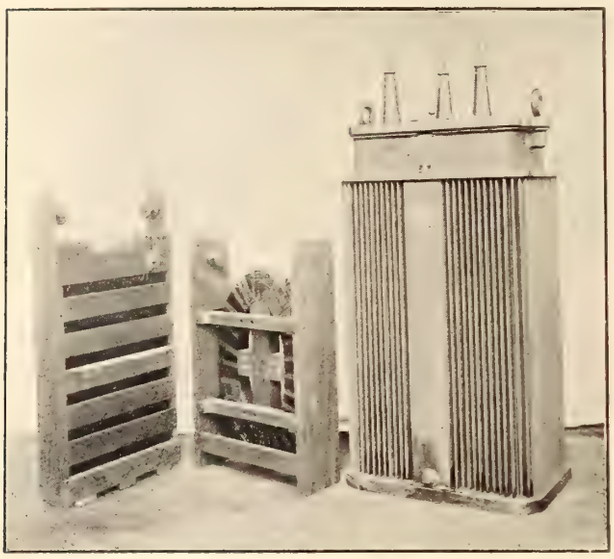


FIG. 3.—COIL, CONDENSER AND CASE FOR STATIC INTERRUPTER.

these static waves is due to their suddenness, which is especially characteristic of lightning.

Grounds in windings, as well as short circuits, may be caused by the excessive potential of such static waves, and apparatus should be protected by lightning arresters with a sufficiently free discharge path. If, however, the momentary grounding of the line due to the discharge of the arrester is very sudden, a certain strain will be produced between the turns of the winding near the terminal. When lightning strikes a line directly, however, which catastrophe fortunately rarely occurs, if the location of the stroke be distant from any apparatus, the lightning will soon leave the line again and reach the earth, probably over a pole. The only disturbance, then, actually reaching the apparatus will be a severe static wave, similar to the secondary waves of lightning already described. If the line be struck close by, however, the apparatus is pretty certain to be injured.

OTHER CAUSES OF STATIC STRAINS.

Other phenomena beside lightning can produce abrupt static waves in electric circuits with their consequent strains on coils; in fact, in some cases these other causes are more troublesome than the lightning itself. Such a state of affairs exists only in very high tension plants. Any cause which produces an abrupt change of potential at the terminal of the transformer or generator coil will cause a strain in its insulation. This may or may not be accompanied by a strain to ground.

The commonest causes of dangerous static waves aside from lightning are, grounding of circiuts; short circuits on lines; charging a dead transformer from a live line; charging a dead line from a live transformer; parallel lines out of phase; disconnecting an unloaded transmission line or cable from a live circuit, etc.

1. GROUNDING A LINE.—If a live wire becomes suddenly grounded, its potential at the point of ground becomes zero practically instantly, and a static wave is started in the line in both directions, which brings all points on the line in succession to zero potential as they are reached by the wave, and finally the terminal of any apparatus containing coils which may be connected to the circuit. This sudden drop of potential gives evidently the condition necessary to cause a strain. In this case of the grounding of the line, however, no increase of strain is brought on the insulation to ground. In the case when one wire of a line becomes grounded, the other or others will receive full potential above the earth. This may mean that the unusual voltage will cause a ground on one or the other of the line wires, which will in turn cause a strain on the insulation between turns of the coils connected to this wire, but this time twice as great as before, since the potential change is numerically approximately twice as great.

2. SHORT CIRCUIT BETWEEN TWO LINES.—When a short circuit between two phases or legs of the circuit occurs abruptly, as by the breaking down of an air gap, the result, so far as static strains are concerned, is the same as though both lines were grounded at the same instant. A strain is thus produced in the apparatus connected to both lines.

3. CHARGING A DEAD TRANSFORMER FROM A LIVE LINE.—This operation is severe on the transformer insulation, for when one of its terminals has been connected to the first line wire and the whole transformer has assumed the potential of this line, the closing of the second line switch changes one terminal of the transformer to the potential of the second line. This is an extremely abrupt change, and causes a severe local concentration of potential.

4. CHARGING A DEAD TRANSMISSION LINE.—The result of charging a dead line at full voltage is to momentarily drop the terminals of the raising transformer to zero potential, since the electro-static capacity of a transmission line is usually very great in comparison with that of a transformer. This sudden momentary drop of the potential has very much the same effect as the discharge of arresters, or grounding of lines. Of course the potential of the line and the transformer are immediately raised again by the generator, but there will always be a momentary drop, as the generator, on account of its inductance, cannot supply current instantly. As an exception to this case, it must be noted that if the transformer be already supplying other high tension lines so that there is a reservoir of electricity to draw from, then the potential of the live line, and transformer will be dropped only part way to zero, by connecting on the new lines, and a less static strain will be produced.

5. PARALLELING OUT OF PHASE.—This is similar to short circuiting, as described above, so far as static effects are concerned, except that as two generators are involved, the voltage may be double the line voltage.

6. DISCONNECTING A LIGHT LOADED TRANSMISSION LINE OR CABLE.—There is one interesting case in whch static strains may be produced that is easily overlooked. If a transmission line or cable be disconnected from a high tension busbar, the charging current of the line or cable is interrupted at the instant that the E.M.F. of the busbars is at a maximum, since at this time the current is zero, and there will also be zero potential between the line and the busbars from which it is being disconnected; therefore, as the current drops out, the line is left with a charge which it will retain for a short time, on account of its high insulation, but the busbars' potential, following the generator, reverses, and when a negative maximum is reached, if the switch is not sufficiently opened, this generator voltage will cause the re-charging of the line. At the next zero point of the wave the current will drop out again, and we shall have the same operation repeated until the switch is finally opened wide enough to prevent the generator voltage from re-charging the line. Thus, the

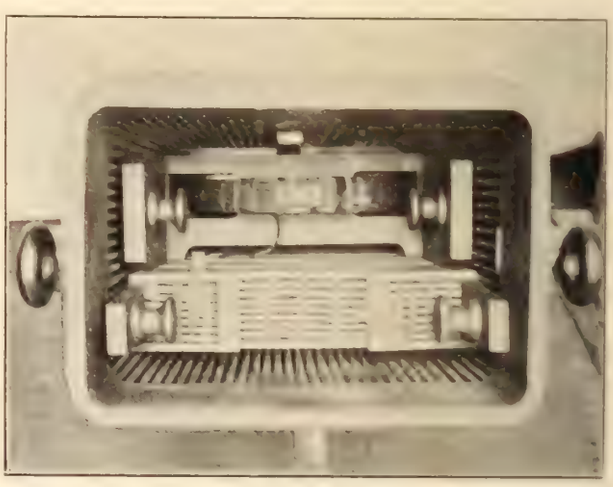


FIG. 4.—INTERNAL VIEW OF INTERRUPTER WITHOUT OIL.

condition of disconnecting a light loaded line evidently may produce the same static strains in apparatus as connecting the line in the first place. Except for lightning, whose maximum possible voltage has no definite limit, these static strains arise originally from the normal voltage of the generator, and in any circuit will be in proportion to this voltage, comparatively high on high tension circuits, and comparatively low on low tension.

So far, it has been assumed that those phenomena causing static disturbances which depend directly upon the E.M.F. of the generator, have occurred at the phase of the E.M.F. wave most favorable for the production of the

static strain; that is, near its maximum. Of course, they will usually occur at other phases of the E.M.F., and the resulting strains will usually be correspondingly less. In fact, any particular form of disturbance must usually happen a good many times before it is certain that it has occurred at a time most favorable for causing static strain. This is one of the facts that make it unusually difficult to trace the effects of static disturbances. All the disturbances designated as static are extremely rapid in comparison with the normal frequency of the generator, so that the line potential must be considered constant while they are taking place.

It will be well to emphasize the fact that in most cases static injuries and sparks between turns leave almost no visible trace and give no sign of their presence until it is too late to avoid short circuit. Therefore, every precaution should be taken to avoid all operations known to produce such strains.

It is usually connecting transformers or circuits rather than disconnecting, and switching out light loads rather than opening heavy circuits, that produce the severest static strains.

CHARGING WAVE IN TRANSMISSION LINE.

The present paper does not aim to discuss fully electric waves in transmission lines, which is a very intricate subject, but probably it will be of considerable interest to consider briefly the manner in which a long transmission line

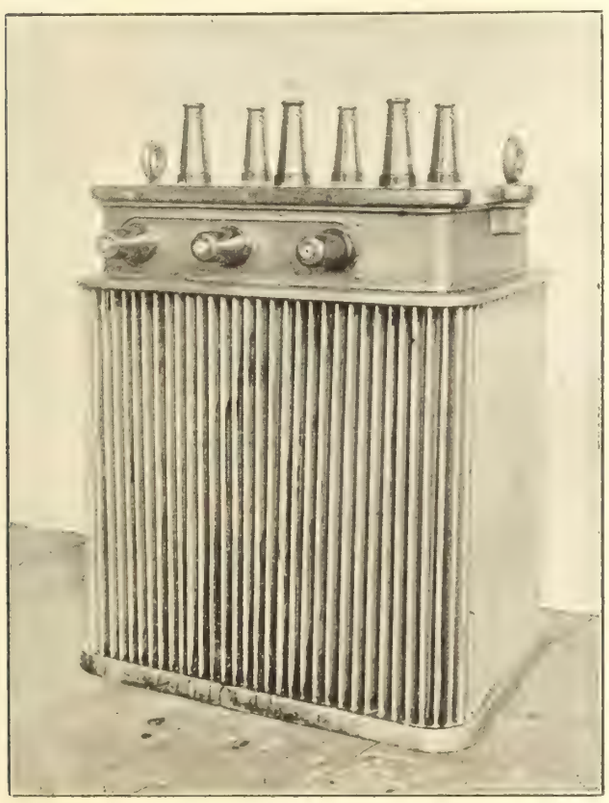


Fig. 5. Case for Triple Pole Static Interrupter.

is charged when suddenly connected to a high tension busbar rigidly maintained at a certain potential.

It must be assumed that the transmission line is long enough so that its inductance will be considerable, otherwise the line will act as a simple conductor. Such a long line may be assumed to be made up of a series of small choke coils and conductors connected in series and distributed as shown in the Fig. 1.

When such a transmission line is suddenly connected to a high tension busbar, a wave is started along the line. This wave passes along at a perfectly definite rate, keeping its original form pretty closely until the end of the line is reached. Here, as the wave can go no farther, it piles up against the end, so as to speak, and is reflected backward toward the source, keeping its form and raising the potential of the line as it progresses just as if it had not been reflected. When the electric wave first passed along the line, it left the line fully charged to busbar potential, and in a steady state. When it turns back after reflection at the end of the line, it again raises the potential an equal amount, so that this time after the passage of the reflected wave the line is left charged to double potential. When this wave reaches the busbar again, its energy is there absorbed and another wave started similar to the first, but reversed in sign, which reduces the line to busbar potential again. This second wave, which is really a "falling" wave, passes to the end of the line and is in turn reflected back. On its backward journey, it reduces the line potential from the busbar potential, where the wave left it on the outward journey, to zero, so that when the busbars is again reached, the line is momentarily in its original condition, entirely uncharged, except at the busbar end. This second wave is absorbed by the busbars, and a third wave started exactly similar to the first, and the charging operation is repeated, and so on indefinitely. The phenomena as described assumes that the line has zero resistance, and that there are no losses of energy. If the line has resistance, as of course it always has, the charging wave is formed in the same manner, only is continually growing weaker as it passes along until it finally dies away and the line gradually comes to rest at normal potential. Thus, the final result is that the whole transmission line passes from zero to double busbar potential forward and backward in very much the same way as a condenser suddenly charged through the choke coil.

PROTECTION OF APPARATUS.

The manner in which lightning and other static disturbances may cause short circuits in apparatus has been pretty fully treated. The most important part of the paper from the point of view of the operating engineer remains, viz., the description of devices for the protection of apparatus from such strains as are dangerous. As already stated, the operation of the arrester in relieving the line of excessive strains to ground will not be further treated.

CHOKE COIL.

Ever since the first introduction of lightning arresters on power circuits, choke coils have been used to some extent as auxiliaries. These choke coils are the type of apparatus which is adapted to protection against static waves, for in passing through a choke coil, a static wave is smoothed or flattened out and its abruptness reduced. As the choke coils frequently used have not always been designed with the definite object in view of protecting particular apparatus from the local concentration of potential, they have often been inadequate. A sufficiently powerful choke coil in the path of a static wave will render the wave practically harmless, but if a less powerful choke coil be used, it may not reduce the severity of the wave materially, and little benefit may be derived. Another important point—different designs of apparatus require different choking power in the coils which protect them, for the static wave must be much more completely smoothed out to relieve from strain a transformer coil of many turns than one of few. This follows, for charge can penetrate into a coil of few turns much more quickly than into one of many.

STATIC INTERRUPTER.

For moderately high voltages, effective choke coils can be constructed and should always be used, but the choking power of these coils should be at least approximately proportional to the apparatus to be protected. But it will be found in most cases in very high tension circuits that if a choke coil powerful enough to prevent dangerous strains be placed in the line, that this coil will seriously interfere with the normal operation of the circuit, or that it will get hot when carrying full load, or have an excessive cost. In other words, such a coil will be found impracticable.

It becomes, therefore, very desirable to find some other way of accomplishing the same purpose without excessive cost or interference with the normal operation of the line. The "static interrupter" is such an arrangement. It consists of a condenser, in connection with a comparatively small choke coil, the condenser being connected between line and ground. The line connection is made between the apparatus to be protected and choke coil. With this arrangement, a comparatively small coil may be used, for the condenser, by absorbing a large part of the charge which passes the coil, multiplies its choking effect. It is possible by increasing the size of the condenser to get almost any desired degree of protection. The multiplying power of the condenser, so to speak, depends upon the relation of its capacity to the electro-static capacity of the outer coils of the transformer or generator that is being protected. Since the electro-static capacity of the transformer is very small, that of the interrupter may be many times larger and yet not be of serious moment in the normal operation of the line. For example, in interrupters actually designed, capacities are rarely as high as .01 M.F.

To summarize, the static interrupter consists of a choke coil and a condenser, forming together a device for effectively rendering harmless the abrupt waves resulting from lightning and similar causes. The protective power of the interrupter must be proportionate to the design of the apparatus to be protected. This adjustment need not, however, be very close. As the interrupter has a choke coil in series with the line, it must be suited to carry a

certain current, and as it contains a condenser, must also be adapted to a definite voltage and frequency. As both coil and condenser experience an energy loss when in use, the case of the interrupter must be so designed as to properly dissipate this heat.

LOCATION OF STATIC INTERRUPTER.

Since switching is one of the prominent causes of static strains in such high tension circuits as require the use of static interrupters, the apparatus should be so placed that no switching shall occur between the interrupters and the transformer or generator to be protected, usually in their leads. In some cases, however, such an arrangement leads to an unnecessarily large number of interrupters. For instance, when two or three, or more, transformers are operated in a group on polyphase circuits, interrupters may usually be placed in the leads of the groups instead of in the leads of the individual transformers. In this case no switching is permissible within the interrupters except under the following conditions.

1. Circuit breakers or fuses may be open under heavy loads or short circuits, since the arc formed prevents any change of potential at the terminal sufficiently abrupt to cause serious local concentration.

2. High tension windings of transformers may be thrown in and out of service at will, provided their low tension windings are excited from the same source as the high tension busbars. Such switching causes no change of potential at the terminal. For example—if it is desired to cut out one transformer from the group of three connected in delta, cut out the high tension winding of the one to be removed from circuit. Though this causes the transformer to drop its load, no material change is made in the potential of its terminals, since the low tension winding is still in parallel with the other transformers. The low tension switchings may now be opened.

In connecting back this transformer to the delta, the low tension should first be connected to the other transformers, which will magnetize the iron and cause the high tension to assume line potential, though it will not of course be carrying any load. The high tension switchings may then be closed without causing any change of potential, and the transformer will pick up its share of the load. On the other hand, if the high tension winding be connected to the busbars first, we have a violent raising of the potential of the terminals. The general arrangement for static interrupters in commercial circuits are shown in Fig. 2.

The static interrupter provides protection against local concentration, but is not expected to provide protection against strains to ground. Of course, as an interrupter (and in fact a lightning arrester choke coil as well) delays as well as smoothes out static waves, it will give an arrester properly placed on the line side of the coil more time to discharge, and will thus indirectly help to prevent strains to ground; but, in general, the static interrupter performs an entirely different function from the lightning arrester. It is supplementary, not a substitute.

CHARACTERISTICS OF COMMERCIAL INTERRUPTERS.

Some of the characteristics of actual interrupters designed by the author for commercial service may not be out of place. In these interrupters, which are illustrated in Figs. 3, 4, and 5, choke coils are wound of several turns per layer and are very heavily insulated; they are wound without iron core.

Condensers are built up with thin copper plates and sheets of insulating material, consisting of special treated fullerboard, the whole being immersed in oil. There are ventilating spaces provided for oil circulation, to prevent dangerous rise of potential in the interior of the condenser. Three leads are brought from the interrupter, one for the line, one for the apparatus and one for the ground connection. The cases are provided with the oil level indicators, by which the depth of oil in the case may be determined without removing the top. The relative location of coil and condenser and the connection between them, are shown in Fig. 4.

HIGH TENSION CONDENSERS.

As comparatively little has been published of the characteristics of high tension condensers, some of their most important peculiarities will be of interest.

1. The charging current, temperature being constant, is proportional to the voltage and to the frequency and to the capacity of the condenser. The capacity (or more accurately, specific inductive capacity) in condensers for interrupters, increases with temperature, though not very fast. Ordinarily an increase of from 10 to 20 per cent. may be expected for a rise from 20°C. to 70°C.

2. The electric energy stored in the condenser measured in watt-seconds or joules, is one-half the product of the capacity in farads, and the square of the voltage. One watt-second equals 11-15 ft.-lbs. The maximum energy actually stored in the condenser of an interrupter for protecting a modern sized 30,000 volt transformer, would be something like three joules = three watt-seconds = 2.2 ft.-lbs.

The statements following refer to condensers of the type used in the static interrupters referred to; other types may have different characteristics.

3. There is a very considerable heat loss in the dielectric of condensers when subjected to alternating voltages somewhere near the safe limit of the insulating strength. These losses may be made to greatly exceed one watt per cubic inch without attaining a voltage high enough to break down the condenser. The loss is approximately proportional to the square of the voltage, and increases very fast with the temperature. If the loss in the condenser is one watt per cubic inch at 20°C., it may be three or four watts, or more, at 80°C. This is at once a very surprising and important result that must be carefully noted in the use of condensers, for a condenser which has a comparatively small loss when running in a cool place may, if transferred to a hot atmosphere, have its loss so increased by the higher temperature as to rapidly heat up and break down. On the other hand, as noted above, the specific inductive capacity which determines the charging current, not the loss, of the condenser, does not vary nearly as rapidly with the temperature, although increasing somewhat.

Condenser losses are very greatly increased by the presence of moisture in the insulating material. A very small amount will cause a dangerous increase. It is consequently very important not to expose high tension condensers to the atmosphere, unless they are thoroughly moisture proof.

The subject of static disturbances is most fascinating, and destined to be of considerable importance on high voltage plants. On account of her numerous water powers, Canada will have a large number of such plants, and her engineers should profit by a careful study of the subject. Much can be gained in relieving the apparatus of static strains without sacrificing the quality of the commercial service, by the careful planning and operation of the plant. In this connection, it will be well to caution engineers against the danger of improperly conducted over-potential tests on apparatus. The specifications of the American I.E.E. for testing the insulation of apparatus provides for the use of a spark gap in connection with the apparatus to be tested, which is expected to break down and prevent any increase in voltage above the testing limit. It is readily seen that such a breakdown of the gap causes the worst condition for producing static strains between turns of coils in the apparatus, as not only is the change of voltage extremely abrupt, but the amount of the strain is much beyond the voltage of normal operation. In all cases where such a spark gap is used, a very high resistance or powerful choke coil should be placed in the connections of the gap to prevent its causing a sudden change in the potential of the terminal of the apparatus by breaking down. In fact, any sparking which may occur in temporary wiring when special high voltage tests are being made upon apparatus may cause injury to insulation.

In conclusion, the writer wishes to remind the Association that there is much to be learned about static strains, and that the only way to determine the full bearing of this subject on commercial electric systems, is by analyzing and comparing the experiences of as many plants as possible, under as many different conditions as may be. Anyone who has an unusual experience with static disturbances will help along the general knowledge by bringing the matter in detail to the attention of someone experienced in such occurrences. A danger well understood is more than half avoided. What we need is more discussion and reports of more actual experiences.

REGISTRATION FEES FOR LIGHTING COMPANIES.

OTTAWA, July 30th, 1902.

Editor CANADIAN ELECTRICAL NEWS:

DEAR SIR:—The regulations governing electric lighting companies have been amended in respect of registration fees. Formerly the classification was that all companies having installations of 1,000 incandescent lamps and under paid a fee of $5.00 per annum and those having installations of 1,000 lamps and over paid $25 per annum. The new classification, which is as follows, makes a reduction in the fees of smaller companies amounting in all to about two thousand dollars annually:

"The registration fee for all companies having an installation of five hundred incandescent lamps and under, five dollars ($5.00) a year, all companies having an installation of over five hundred and not exceeding two thousand incandescent lamps, a fee of ten dollars ($10.00) a year, and all companies having an installation in excess of two thousand incandescent lamps, a fee of twenty five dollars ($25.00) a year.

For the purpose of this regulation each arc lamp shall be deemed equal to ten (10) incandescent lamps.

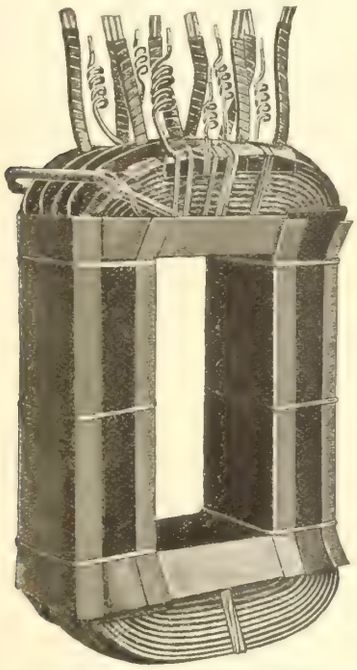
Each company registering shall be entitled to a test of voltage and a comparison of their measuring instruments with the Departmental standards once in each year free of charge."

Yours very truly,

O. HIGMAN, Chief Electrical Engineer.

THE WESTINGHOUSE TYPE N TRANSFORMER.

As the Westinghouse Company was the first to introduce the practice of winding for two primary and two secondary voltages, it is not surprising that this company has taken another step forward in the same direction by bringing out a transformer provided with additional voltages. The new transformer, Type N (shown herewith), is not intended to replace the company's well known O.D. transformer, but rather to fill the demand for a reliable transformer, which, provided with additional ratios of transformation, has a greatly extended range of voltage. The shell type of construction is used as in Westinghouse O.D. transformers and in the company's large high voltage transformers up to 100,000 volts and 2,730 kilowatts capacity.



Assembled Coils of Westinghouse Type N Transformer Showing Special Coil Feature.

The primary winding of the Type N transformer is divided into equal parts, which may be connected in series or in multiple. The secondary winding is divided into four equal parts, which may be connected in series, series-multiple or multiple. The primaries of all transformers are wound nominally for 1,000 and 2,000 volts. Transformers from ½ to 25 K.W. inclusive are wound for nominal secondary voltages of 50, 100 and 200 ("Class 200"), and those from 2 to 50 K.W. inclusive for voltages of 100, 200 and 400 ("Class 400"). The secondary voltages in each class of transformers can be varied to suit either the varying line voltages of an extensive transmission system, or to give special voltages from standard circuits. All transformers are arranged for three wire secondary distribution, and the secondary coils cross-connected to give equal voltages on both circuits, even with large unbalanced loads.



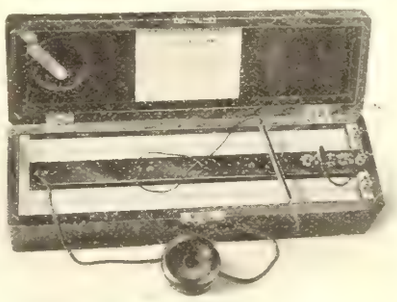
1 K. W. Westinghouse Type N Transformer.

SAGES' DIRECT READING OHMMETER.

To fill the demand for an instrument capable of quickly measuring resistance in much the same way that a portable voltmeter measures volts and a portable ammeter measures amperes, Mr. C. E. Shedrick, of Sherbrooke, Que., has placed upon the Canadian market Sages' direct reading ohmmeter, an instrument for the purpose of measuring resistance which is portable, direct reading, accurate, simple and cheap.

This instrument, shown in the accompanying illustration, depends upon the well known Wheatstone bridge principle, and therefore the strength of the battery in no way affects its accuracy. It consists of two wires of special alloy, which are stretched over suitably graduated scales. Several independent resistances are provided, which are connected in the proper way by means of a plug which will fit in any one of the four holes provided for it on the right hand end of the instrument. Thus there is only one plug in circuit, and the possible error from poor plug contact is very remote. Two binding posts are provided, across which the resistance to be measured is connected. These posts are marked xx. A telephone receiver suitably connected to the device is held to the ear, and the little key K is pressed shut with the thumb. This closes the battery circuit. A stylus is provided, which is held in the hand in much the same manner as a pen, and this is touched at various points along the wire until a point is found at which no click will be heard in the telephone receiver.

To begin the measurement, the first step is to touch each of the two outer binding posts; two clicks will be heard of different intensity, and the post which gives the faintest click is on the scale on which the point of silence will be found. The brass connecting block at the end of this scale is then touched with the stylus, and the end which gives the faintest click is nearest to the point of silence. In three touches of the stylus therefore the desired point is located on a given quarter of the total scale. This quarter is rapidly traversed by the stylus, and the point of silence is soon found. After a few trials ten or twelve seconds will suffice for this operation. The scale under the point of silence is read directly, and gives the desired resistance in ohms.



Sages' Direct Reading Ohmmeter.

The simplicity of the instrument is obvious; there are no pivots to break, no large number of plugs to loosen, no multiplicity of binding posts. The telephone receiver as a detector renders it independent of levelling, stray magnetic fields, and of vibration.

The battery contained within the instrument consists of six small dry cells and can be renewed at any time by the owner at an expense of less than two dollars. The battery is guaranteed to last six months with continuous use.

Mr. Shedrick would be glad to send prices to persons interested in this instrument.

SPARKS.

The electric lighting system of Amherstburg, Ont., is to be extended.

The Vancouver branch of the Canadian General Electric Company is now located at 527-529 Granville street, in a new building just completed by them.

E. Leonard & Sons, of London, Ont., have secured the order for three Peerless self-oiling engines of 90 horse power each for the Montreal Board of Trade building.

The Standard Light & Power Company is about to install a steam heating plant in Montreal. The electric plant is now situated on Chenneville street, from which it is proposed to run steam pipes underground to the consumer.

The new engines for the Halifax Electric Tramway Company will be obtained from the Providence Engineering Company, of Providence, R.I., and will give a total capacity of 1,500 horse power. The Canadian General Electric Company will supply the electrical apparatus, the Babcock & Wilcox Company, of London, Eng., and Montreal, the boilers, and the Jones Underfeed Stoker Co., of Toronto, the stokers.

DUPLEX INSTRUMENTS.

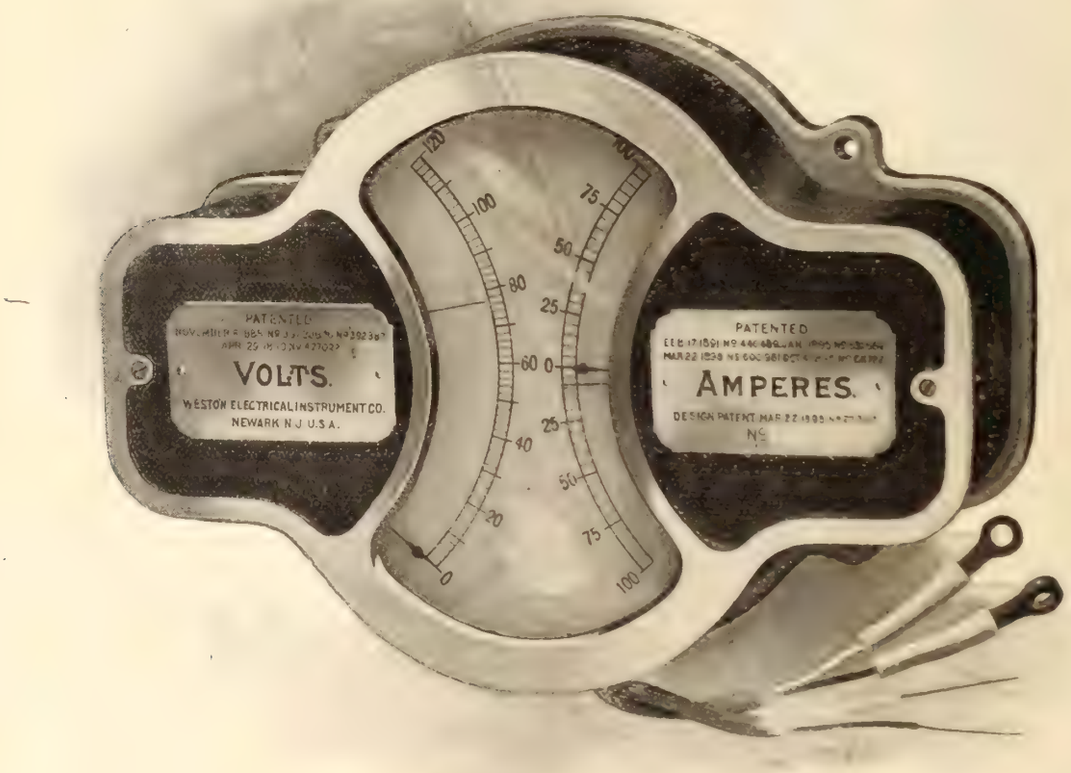
A new product has been placed on the market by the Weston Electrical Instrument Company, of Newark, N.J., in their duplex instruments. These instruments are called "duplex" because they contain a voltmeter and an ammeter in one case. For some purposes this combination, it is claimed, will be found much more useful than two instruments in separate cases. For instance, in many cases where practically simultaneous readings of current and potential difference are to be made, these instruments will be found more convenient to use on account of the close proximity of the scales and indexes, and they will also be found specially useful in all cases where space is limited and compactness is a necessary or desirable feature.

At present the Weston Electrical Instrument Company make two models of this type of instrument, designated R and T. Each has for some uses specially desirable features not found in the other. In model R the two instruments are enclosed in a neatly designed and nicely finished waterproof aluminum case, which closely surrounds the operative parts of the instruments. The use of an aluminum case secures the minimum weight. This model is well adapted for outside use, where the instrument is exposed to the weather. They are particularly suitable for use on an electric vehicle on account of extreme lightness, compactness, and freedom of danger from injury by water, snow, moisture, or dust and dirt. The instrument and moving parts are so constructed as to be able to bear without injury the constant vibration to which such instruments are subjected while in use on vehicles.

MOTOR CARRIAGES IN SOUTH AFRICA.

South Africa seems a promising field for the sale of auto-motor lorries. According to the "British and South African Export Gazette," mechanical motors are slowly but surely winning their way to popular favour in South Africa. The Table Bay Harbour Board have recently placed orders for six steam lorries for use in the delivery of cargo from the docks, and the first of these to arrive has already made trial trips with, we believe, complete satisfaction. Kimberley citizens have likewise lately made initial acquaintance with these vehicles, the first of its kind seen there having lately been imported. An order for a number of motors will also be shortly forthcoming for Mafeking, while the South African Motor Car Syndicate, Durban, have just secured the approval of the Town Council to run a line of motors to Sydenham, Umgeni, and the South Coast Junction, which will be eventually extended to the whole of the suburbs and the outlying districts. Having previously imported their cars, the service is now probably in full swing. Doubtless these details, merely a few out of many, mark only the incipient stages of a coming big demand for motors, for if there is anywhere an opening for mechanical traction it is on the extensive roadways of the several colonies now badly served by ox-wagon transport.

The same authority also points out that there is now a growing demand for agricultural implements and machinery in that region. The use of agricultural appliances is also making its way among the numerous native tribes to the north of the Zambesi, and a very considerable demand has arisen of late.



Model "R" Duplex Instrument.

These model R instruments are not well suited for use in cases where powerful external magnetic fields exist, since such fields would disturb the accuracy of their indication. They are, however, exceedingly well adapted for use on small switch-boards and especially on motor-starter switch-boards, where they will be found to render very valuable service in indicating the power used in driving single machines or groups of machines.

In the model T the working parts are precisely the same as in model R, except that the scale is larger, the case is made of cast-iron and is not waterproof, and does not closely surround the working parts of the instrument. This type is well adapted for use in small isolated plants and for all cases where the existence of powerful external fields would render it impossible to use the R model. The function of the cast-iron case is to shield the instrument from external fields, and this it does in a most effectual manner.

The Westinghouse Electric & Mfg. Co. reports the sales of Westinghouse integrating wattmeters for the month of June to have been the largest in the history of the company.

Mr. Frederic Nicholls, general manager of the Canadian General Electric Company, has purchased an extensive property on Lake Simcoe, near Barrie, for the purpose of a summer residence, and with his family is spending the vacation there this year.

British manufacturers would do well to ascertain the exact nature of the wants in these districts.

"RENEWABLE" INCANDESCENT LAMP.

A "renewable" electric incandescent lamp was exhibited recently in England. It is an ordinary lamp of excellent make averaging more than the usual life, and with an efficiency of between 2½ to 3 watts per candle power. Its use certainly saves current, but that is, after all, its least advantage. Thanks to improvements under various processes, and more especially to the adoption of a very novel and ingenious mode of fastening the filament, says the Boston Transcript, the new filament can be fitted to the lamp, thereby saving the platinum, cap, bulb and wires, provided, of course, the bulb is unbroken. This can be done as often as needed. The result is that the lamps are renewed indefinitely at just one-half their original cost. All the user of a 5 to 25 candle power lamp, costing twelve shillings a dozen, has to do when it gives out is to send it to the company and they will put in a new filament and send it back as good as new, at a charge of twelve cents.

Mr. A. E. Edkins, inspector for the Boiler Inspection and Insurance Company, and Mr. W. J. Webb, chief engineer for the Lawlor Estate, will leave Toronto on August 20th on a pleasure trip to England.

CANADIAN ASSOCIATION STATIONARY ENGINEERS.

THE ANNUAL CONVENTION.

The Canadian Association of Stationary Engineers will hold their thirteenth annual convention in Engineer's Hall, Victoria street, Toronto, on August 19th and 20th. The chair will be occupied by the president, Mr. Charles Moseley. The business will include the consideration of a proposal to affiliate with the International Association of Steam Engineers. The license law will also be throughly discussed with the object of deciding upon some definite plan of procedure. On Tuesday evening the delegates will be given a moonlight trip on the street cars, and will attend a banquet at the Humber. An open meeting will be held on Wednesday evening, when it is likely that the proposal to amalgamate with the International Association will form the chief topic of discussion. A plebiscite vote has been taken on the subject, with the result that only the Brockville Association voted in favor of the proposal.

There was a large representation of stationary engineers from Eastern Ontario at a meeting held in the Orange Hall at Brockville last month to transact general business and to discuss three important questions submitted for consideration by the Executive. The questions were as follows:

(1) Will affiliation with other bodies be of benefit to this body?

(2) Would it be wise to sink the identity of this organization and join some international body?

(3) In the event of affiliating with other labor bodies, would it be better to retain the identity of this organization and simply send delegates to the affiliated body?

After a discussion lasting over two hours, a resolution was passed adopting the course suggested by the third question. The boiler inspection law was then taken up and shown to be a direct failure. The engineers' bill was also considered and the parliamentary members censured for their absence when divisions were made in committee, especially those who pretended to favor the different bills. Mr. Geo. P. Graham, M. P. P., was given credit for the active part taken in connection with the engineers' bill.

Mr. W.F. Chapman, member of the board of examiners for the Ontario Association, was chosen to represent the Association. He has made a study of the questions involved and will go fully prepared to carry out the wishes of the Association to the satisfaction of all parties interested. JAS. AIKENS, Secretary Brockville No. 15.

A SPORTING GUARD.

In the county of Shropshire there is a line known as the Bishop's Castle Railway, which is run in a very primitive manner. The company to which this line belongs owns one engine and just sufficient rolling-stock to make up one train of the mixed variety. A gentleman who owns a property at one end of the line was travelling one day in this train, when it was stopped half way between two stations; the stoppage was rather a prolonged one. Getting impatient he looked out of the window to find out the reason, and seeing the stoker sitting on the footboard, smoking his pipe, he asked him, "Is there anything wrong?" "Oh nothin'," said the stoker, "it's only my mate as got out to pick mushroons."

LEGAL.

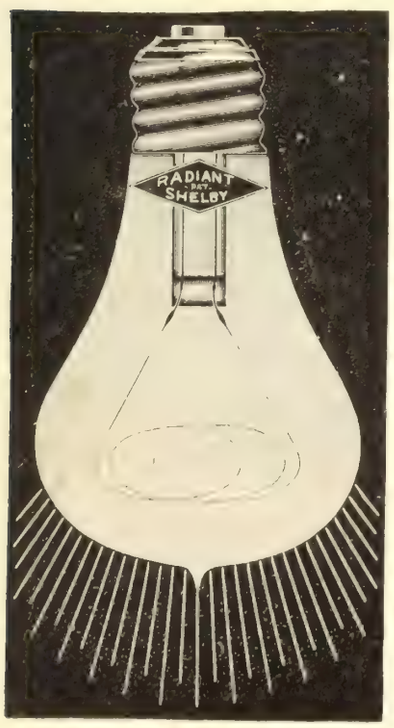
The courts have dismissed with costs the appeal of the Hamilton Electric Light and Power Company from the decision of the lower courts in the case of Hopkins vs. the Company. The plaintiff was granted an injunction restraining defendants from operating dynamos and other electrical machinery in a manner to cause vibration and brilliant flashes of light to the alleged annoyance of plaintiffs' family and injury to their health.

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One 600 h. p. Rep'ogle Water Wheel Governor.
One lot of Wood and Iron Pulleys.
One lot of good 2nd hand Belting.
One lot of good 2nd hand Schallenberger Meters

Write for prices.

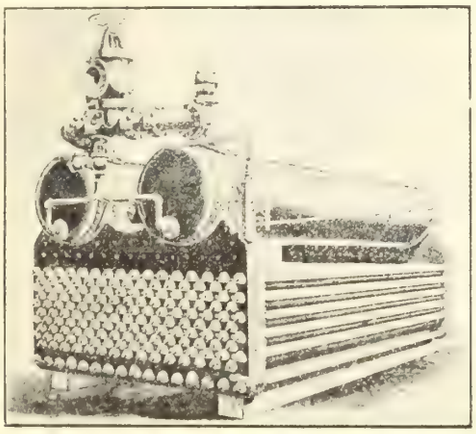
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The first cement plant in Canada to be operated by electric power is that of the National Portland Cement Company at Durham, Ont. All of the cement-making machinery in this plant will be driven by induction motors, supplied with current by two Westinghouse 450-kilowatt, three-phase alternators. These machines are of the engine type, with revolving fields, and run at 125 revolutions per minute, 3,000 alternations and 600 volts. Two exciting units are provided, one consisting of a 62½ kilowatt, 125 volt, engine type, direct current generator, direct connected to an automatic engine, and the other of a 56½ kilowatt machine, coupled to an induction motor. The output of the exciters will be used, not only for exciting the fields of the alternating current generators, but also for arc and incandescent lighting throughout the works and grounds.

Mr. Emerson P. Harris concludes an article in Newspaperdom on "The Field of the Trade Paper," as follows: The solid rock of hope for the trade press is the fact that of all periodicals it renders the greatest service with the highest degree of efficiency, with the least waste and greatest economy. The trade press which has practically grown up in the past twenty-five years, and has undoubtedly quadrupled in output in the past decade, has a great future before it.

TELEPHONE POLES FOR SALE

THE UNDERSIGNED HAVE IN STOCK, and ready for shipment, 2,000 Cedar Telephone Poles, all lengths, 25 to 60 feet. Prices quoted by mail or wire for car lots f. o. b cars this station or delivered at points required.

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Moreover, regular subscribers are allowed to advertise without charge in the paper—See the rules.

Tenders Wanted

Tenders are invited by the Corporation of Annapolis Royal, N. S., for the installation and extension of the

Electric Lighting Plant

in the above mentioned Town. Plans and specifications of proposed installation may be had or seen by intending Contractors at the office of the Town Clerk, Annapolis Royal, N.S. All tenders to be sealed and to be marked "Tenders for Light Extension" and to be in by NOON OF AUGUST 15TH, 1902.

Tenders are also invited for the construction and erection of a Dam, Flume, Power House, Water Wheel, Draft Tube, etc., complete, in connection with the above electrical installation. Plans or specifications may be had or seen by intending contractors at the office of the Town Clerk at Annapolis Royal, N. S. All tenders to be sealed and to be marked "Tender for Hydraulic Work" and to be in by NOON OF AUGUST 8TH, 1902.

FRED W HARRIS,
Town Clerk.

Annapolis Royal, July 19th, A.D., 1902.

TENDERS WANTED
A Weekly Journal of advance information and public works.
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CANADIAN CONTRACT RECORD
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STORAGE BATTERIES

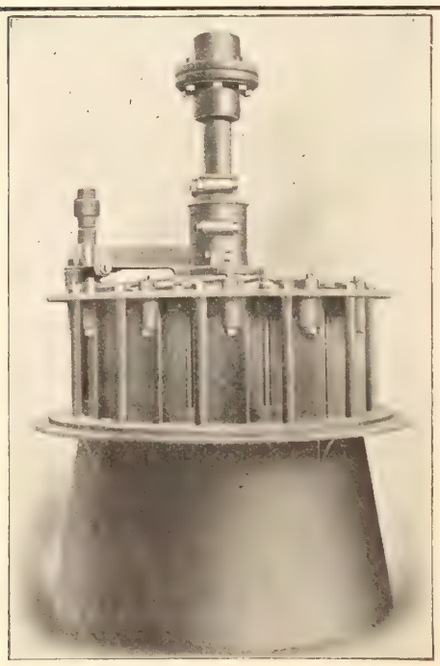
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THE CANADIAN ELECTRIC LIGHT COMPANY.

The annual meeting of the Canadian Electric Light Company, of Levis, Que., was held on July 10th. The report covered eleven months ending April 30th, 1902, and showed the earnings to more than cover the bond interest and charges, including the interest on capital essential to provide additional machinery and extensions which will soon become necessary. The number of lights installed on April 30th last was 7,803 16 c.p., as compared with 5,000 one year ago. In conjunction with the horse power in motors, there was an equivalent in 16 c.p. lamps of 17,805.

The report stated that it was imperative to provide an additional penstock, wheel and generator, together with a standpipe to care for the larger load without putting an undue strain on the wheels and penstock. This will increase the capacity by over 60 per cent.

Hon. Mr. Pelletier was elected president and Messrs. Gaspard Lemoine and H. T. Mashon vice-presidents.

SPARKS.

The Cascade Power Company is now building its transmission line into the Granby and Phoenix mining districts.

A new dynamo and twenty enclosed arc lamps are to be purchased for the municipal electric light plant at Collingwood, Ont.

The Ontario Government purposes utilizing electricity for pumping, laundry, and other purposes at the Asylum for Idiots at Orillia.

It is reported that Folger Bros., of Kingston, Ont., are considering the utilization of water power for operating the street railway in that city.

Dexter Griffiths was instantly killed recently by a live wire while working in the power house of the Cataract Power Company at St. Catharines, Ont.

A by-law to provide $15,000 for the installation of a civic electric lighting system will be submitted to the ratepayers of St. Boniface, Man., on August 14th.

Messrs. W. P. & J. P. Hare, of Toronto, have patented an electric train signal device which has been tested and is claimed to have never failed to give satisfactory results. In addition to giving warning of the approach of other trains and open switches, the invention takes the place of semaphores and lights in case of fogs or storms.

The plant and property of the People's Heat & Light Company at Halifax, N. S., has been transferred to the Halifax Electric Tramway Company, at the price of $350,000. The latter company now control the electric and gas lighting of the entire city, as well as the street car service. It is said that the company have recently adoped a new scale of wages for conductors and motormen, under which the men will receive 14½ cents per hour for the first year of service, 15½ cents for the second, 16 cents for the third, 16½ cents for the fourth, and 17 cents for the fifth year. About half the men now in the employ of the company will receive the maximum wage. The new engine and power house of the company is nearing completion.

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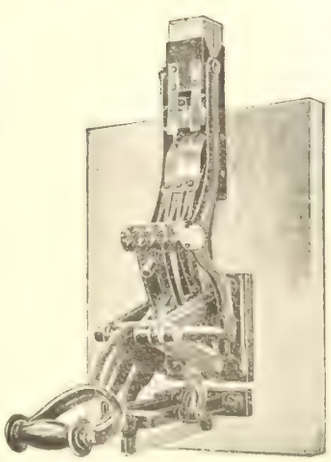
774 Craig Street, MONTREAL, P.Q.

have arranged their works for repair work only. They keep armatures of nearly all makes of dynamos in stock, which they loan while repairs are being made. Their factory is so arranged that they can run night and day, and work can be finished in the shortest possible time. **Telephone Main 3149.**

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PUBLICATIONS.

Price list No. 313, issued by the Canadian General Electric Company, contains prices and tables relating to wire and cables.

A catalogue has recently reached us from the Eugene F. Philips Electrical Works, of Montreal. It is neatly bound in leather cover, and contains, in addition to prices, many valuable tables of resistances, weights, differences between wire gauges, carrying capacities, etc., of copper wire, iron line wire, galvanized steel wire, lead encased cable and other products manufactured by this company.

A book of 140 pages has reached our desk from the Stillwell-Bierce and Smith-Vaile Company, of Dayton, Ohio. It is designated General Catalogue No. 42, and contains almost everything that one would wish to know regarding the celebrated Smith-Vaile pumping machinery. Their line of pumping machinery is as complete as can be found anywhere on the American continent, and the fact that they have been engaged in constructing and designing pumps for a period of thirty years assures the buyer that he will secure the latest improvements. Persons interested in pumping machinery who have not received this catalogue should write for a copy.

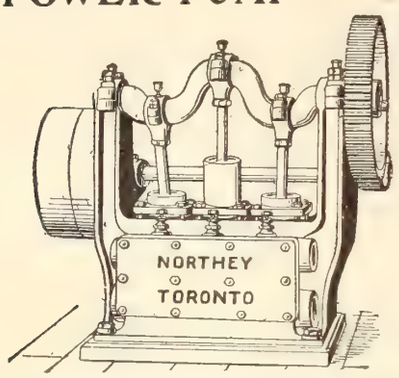
SPARKS.

The ratepayers of Prince Albert, N. W.T., are to vote on a by-law on August 15th to raise $15,000 for installing an electric light and power plant. Mr. F. H. Clinch is secretary of the corporation.

There has been organized at Niagara Falls, N. Y., a company called the Ontario Power Transmission Company, which proposes to transmit power generated by the Ontario Power Company on the Canadian side to Niagara Falls and other places.

The Chambers Electric Light & Power Company have issued two writs against the town of Truro, N.S., for disputed accounts for lighting. They claim that a contract exists for lighting the town at 9 cents per 1,000 volts, and sue for $3,376.55. In case the court decides no contract, the suit is for $4,551.22, at the usual rate charged by the company, 12½ cents per 1,000 volts.

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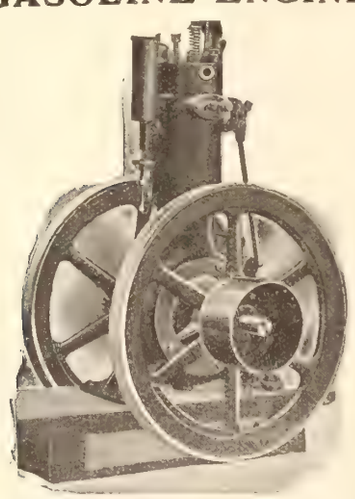


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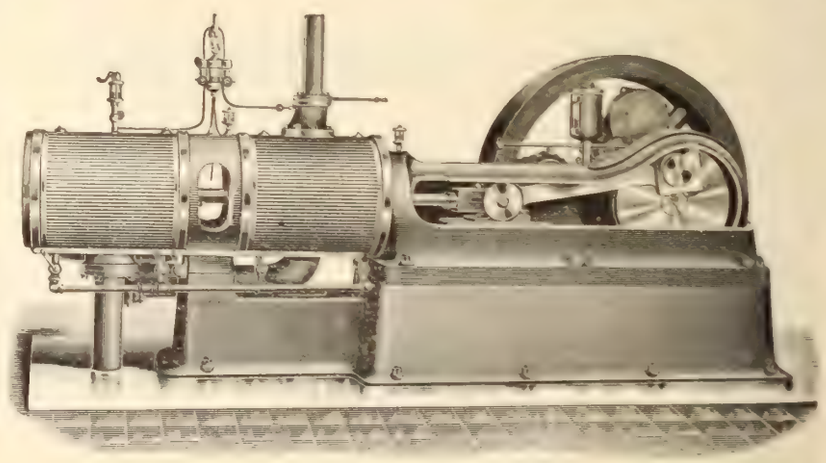
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SPARKS.

The Dominion government has taken tenders for the construction of a telegraph line from 150-mile House to Quesnell Forks, B. C., a distance of about 60 miles.

The corporation of Revelstoke, B. C., have offered the Revelstoke Water, Power & Light Company $55,000 for their property, bnt the offer is not likely to be accepted.

The Cataract Power Company, of Hamilton, have decided to install a 3,500 horse power steam plant in the transformer station on Victoria avenue north, to be used as an auxiliary.

The switch-board in the station of the Royal Electric Company on Queen street, Montreal, was slightly damaged by fire recently.

The Lachine Rapids Hydraulic & Land Company have purchased property on St. Thomas street, Montreal, on which it is proposed to build a sub-station.

The incorporation is announced of the Canadian Telephone Company, Limited, with a capital of $250,000. The head office of the new company will be at Ottawa. The directors include Hon. George E. Foster, Robert Neil, Michael Ludwig and J. A. Phin.

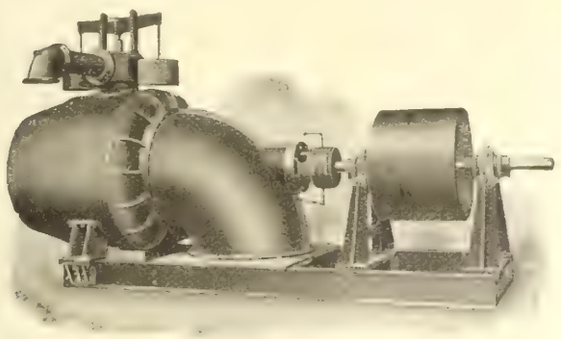
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TRADE NOTES.

Messrs. Fogarty Bros., electrical contractors, Montreal, have removed to 118 St. James Street, where they will be pleased to meet their customers.

The R. E. T. Pringle Company, Limited, of Montreal, have issued Bulletin No. 2, referring to polyphase induction motors for various purposes as manufactured by the Ampere Electric Manufacturing Company. Excellent views of the works of this company are shown.

The Packard Electric Company, of St. Catharines, Ont., have issued a neat pamphlet describing the type "G" Scheeffer recording wattmeter, which is now manufactured at their factory at St. Catharines.

Messrs. John Starr, Son & Company, of Halifax, N. S., are supplying the electric light and power equipment to operate the pulp and paper mills of the St. George Pulp & Paper Company now being built at St. George, N. B. The Jenckes Machine Company, of Sherbrooke, Que., are furnishing the water wheels and steel tubes.

SPARKS.

Messrs. Peter Ryan, J. Thompson, William Bain and others have been incorporated as the Malaga Suburban Railways, Limited, with head office in Toronto and a share capital of $500,000.

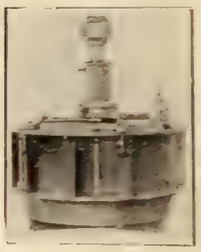
The Modern Telephone Company, of Hamilton, Limited, has been incorporated by Messrs. O. W. Rogers, F. Leoffer, J. S. King, W. A. Johnson, H. A. Drummond, W. Vandusen, S. C. Biggs, and J. B. Scovell. Mr. Rogers is a New York lawyer and professes to be able to operate his system on a single wire.

Messrs. Ahearn & Soper, of Ottawa, have competed the installation at Montreal and Chambly of twenty Westinghouse transformers, claimed to be the largest in size and greatest in capacity ever manufactured in the world. Each transformer has a capacity of 35,500 lights, making a total of almost three quarters of a million lights.

Mr. A. M. Wickens, electrician of the Ontario Public Works Department, has installed a new electric light plant in the Ontario Agricultural College at Guelph, Ont. It has a capacity of 2,000 incandescent lights and was supplied by the Canadian General Electric Company, the wiring being executed by the Guelph Light & Power Company.

In one of the collieries of the Nova Scotia Steel & Coal Company at Sydney Mines, N. S., modern equipment has been introduced. It will be known as a smokeless colliery, as electricity will be used entirely for hoisting, hauling, coal cutting machines, etc. The steam for the generators will be made from the waste gas of the furnaces and the coke ovens.

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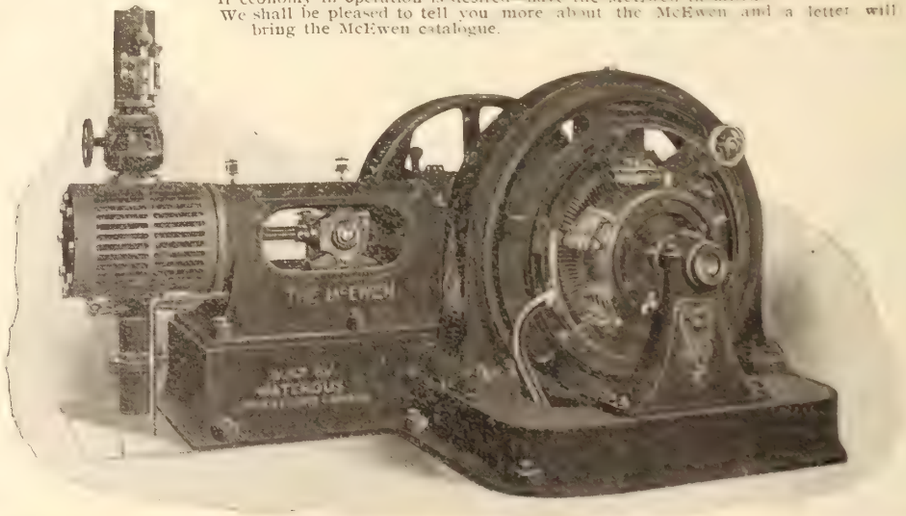
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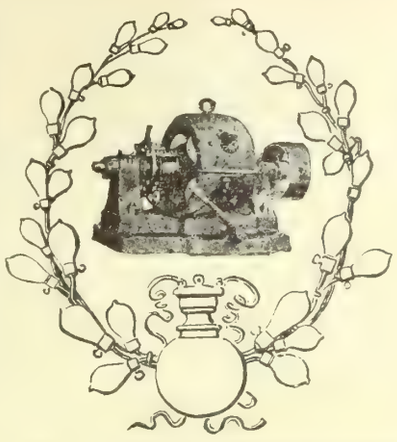
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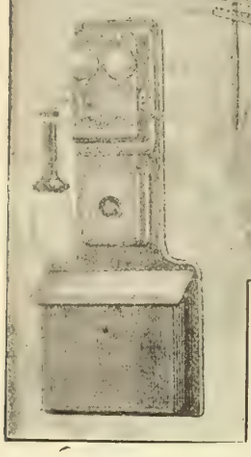
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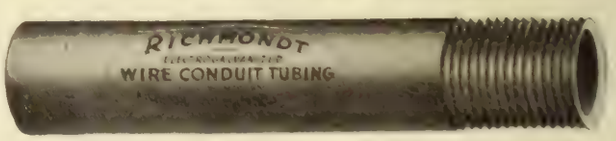
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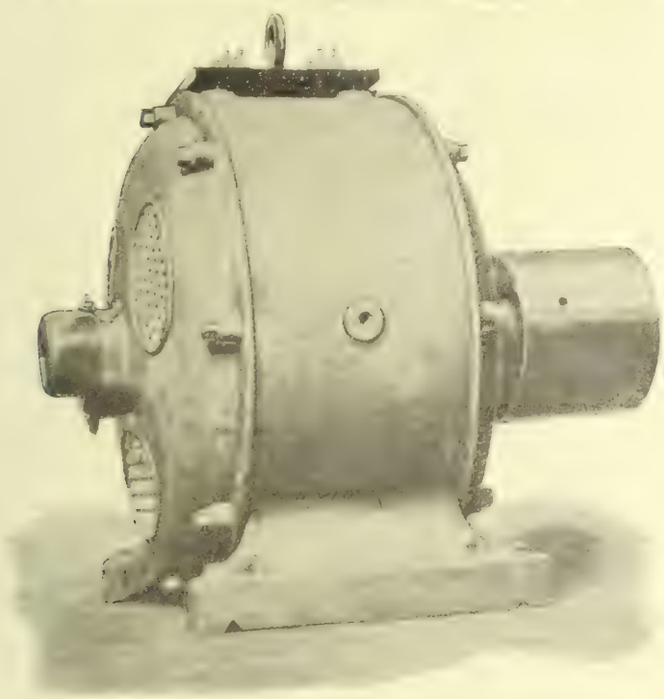
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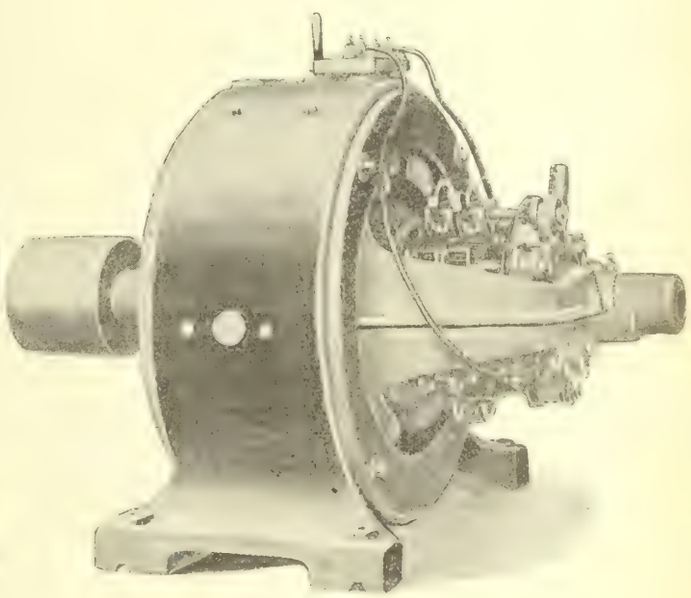
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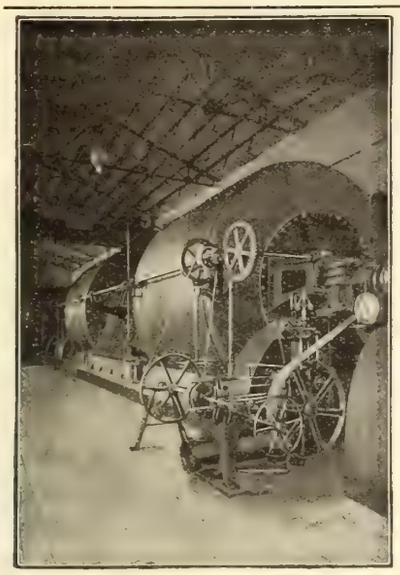
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Recently received the following unsolicited testimonial, which speaks for itself :

TORONTO, Aug. 6th, 1902.

THE GOLDIE & MCCULLOCH CO , GALT, ONT.

DEAR SIRS :—In our recent fire which, as you know, was a total wreck, and of which we are sending you a photo by this mail, we had two Goldie & McCulloch safes in which we kept all our books. They have come through the fire in remarkable shape and we feel that our praise for your safes cannot be great enough. This fire was an extremely hot one, the locality in which these safes were being surrounded by hay and grain as well as large quantities of packages, barrels and boxes. We might say that everything was burned to a crisp, heavy iron being twisted and melted into frightful shape. We had almost given up all hope of being able to get the books and documents from the safes in such a manner as to make them of any use to us, which we can assure you would have been a very serious matter. We were agreeably surprised, however, on reaching them. While we found the safes somewhat warped and bent on the outside, yet all our books and documents came out in such a manner that we can get everything from them all right. This without a doubt was an extremely hot fire, and the way in which they came through it leaves no room for question as to the manner in which they are made and the stuff they are made of.

Again congratulating you on the safes you turn out and trusting we will have the pleasure of purchasing from you when we again rebuild, as we know of none better, we are,

Yours truly,
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SPARKS.

The power house of the Parrsboro Electric Light Company at Parrsboro, N. S., was recently damaged by fire.

A by-law was carried by the ratepayers of St. Boniface, Man., to provide $15,000 for an electric light plant.

A company is being formed to establish electric light and telephone systems at Moosomin, N. W. T.

A new waterworks pumping engine will likely be purchased by the city of Toronto.

The corporation of Revelstoke, B. C., has offered $62,500 for the property of the Revelstoke Water, Light & Power Company.

The Sussex Electric Company, of Sussex, N. B., have just installed a Leonard tandem compound engine to provide power for increased lighting.

Seneca township council has passed a by-law granting the Hamilton & Caledonia Electric Railway Company right of way to Cayuga, Ont.

It is reported that Mr. Hogg is organizing a company to develop the Eugenia Falls water power, for the purposes of supplying electric light and power to the villages of Dundalk, Flesherton and Markdale.

It is reported that several Brantford merchants are organizing a company to establish an electric light plant at Holmedale, for the purpose of supplying Brantford and vicinity.

Goodale Bros. have been awarded the contract for the construction of the Hamilton, Grimsby and Beamsville Electric Railway from Beamsville to Vineland.

Improvements are being made to the electric light plant at Markdale, Ont., a contract for bulkhead and steel flume having been given to the Owen Sound Iron Works Co., of Owen Sound.

Mr. F. H. Clergue has signed contracts awarding the construction work for the St. Mary's Traction Company, which includes road bed, track laying and electric equipment, to the Falk Company, of Milwaukee.

The ratepayers of Windsor Mills, Que., have voted in favor of installing a plant for electric light. It is proposed to develop the Clarke water power, which has a head of 25 feet. A steam engine will be installed as a reserve.

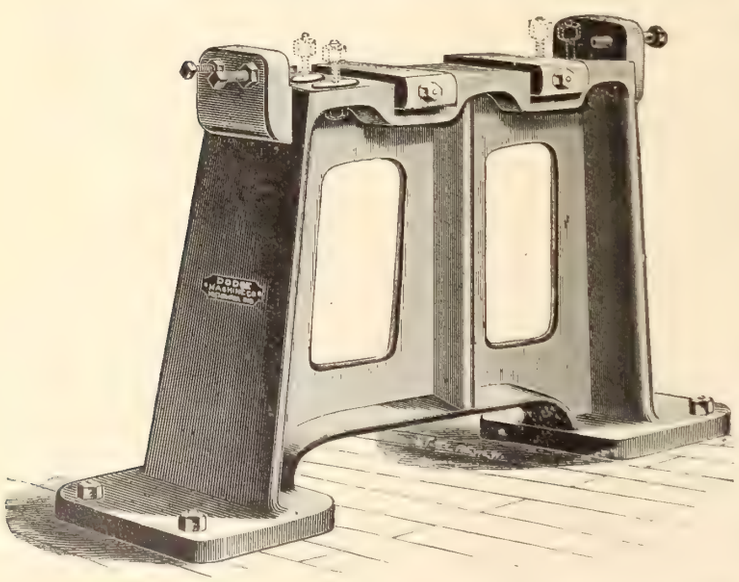
The item in last issue to the effect that the cement plant of the National Cement Company was the first in Canada to be operated by electric power was incorrect, inasmuch as the Lakefield plant has been in operation for some time, the power being electricity. The electrical apparatus wass installed by the Canada General Electric Company.

MOONLIGHT SCHEDULE FOR OCTOBER.

Day of Month.	Light.	Extinguish.	No. of Hours
	H.M.	H.M.	H.M.
1....	P.M. 6.15	P.M. 5.15	11.00
2....	" 6.15	" 5.15	11.00
3....	" 6.15	" 5.15	11.00
4....	" 6.15	" 5.15	11.00
5....	" 6.00	" 5.15	11.15
6....	" 6.00	" 5.15	11.15
7....	" 8.00	" 5.15	9.15
8....	" 9.00	" 5.15	8.15
9....	" 9.45	" 5.30	7.45
10....	" 10.45	" 5.30	6.45
11....	" 11.40	" 5.30	5.50
13....	" 0.40	" 5.30	4.50
14....	" 1.45	" 5.30	3.45
15....	" 2.45	" 5.30	2.45
16....	No Light.	No Light.	....
17 ...	"	"	....
18....	"	"	....
19....	A.M. 5.40	A.M. 8.45	3.05
20....	" 5.40	" 9.40	4.00
21....	" 5.40	" 10.40	5.00
22....	" 5.40	" 11.40	6.00
23....	" 5.40	" 0.45	7.05
24....	" 5.40	" 1.45	8.05
25....	" 5.40	" 3.00	9.20
26....	" 5.30	" 4.00	10.30
27....	" 5.30	" 5.00	11.30
28....	" 5.30	" 5.45	12.15
29....	" 5.30	" 5.45	12.15
30....	" 5.30	" 5.45	12.15
31....	" 5.30	" 5.45	12.15
		Total.....	229.15

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For Electric Light and Power Plants.



Floor Stands,
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Steel Shafts,
Friction Clutch Pulleys,
Clutch Couplings,
Iron Pulleys,
Iron Centre Wood Rim Pulleys
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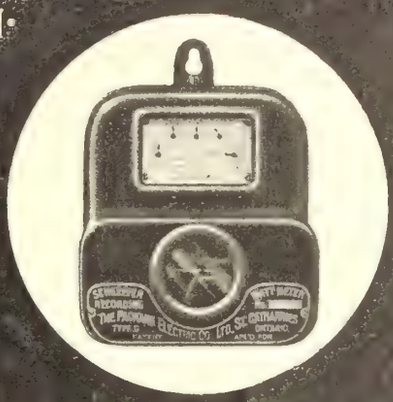
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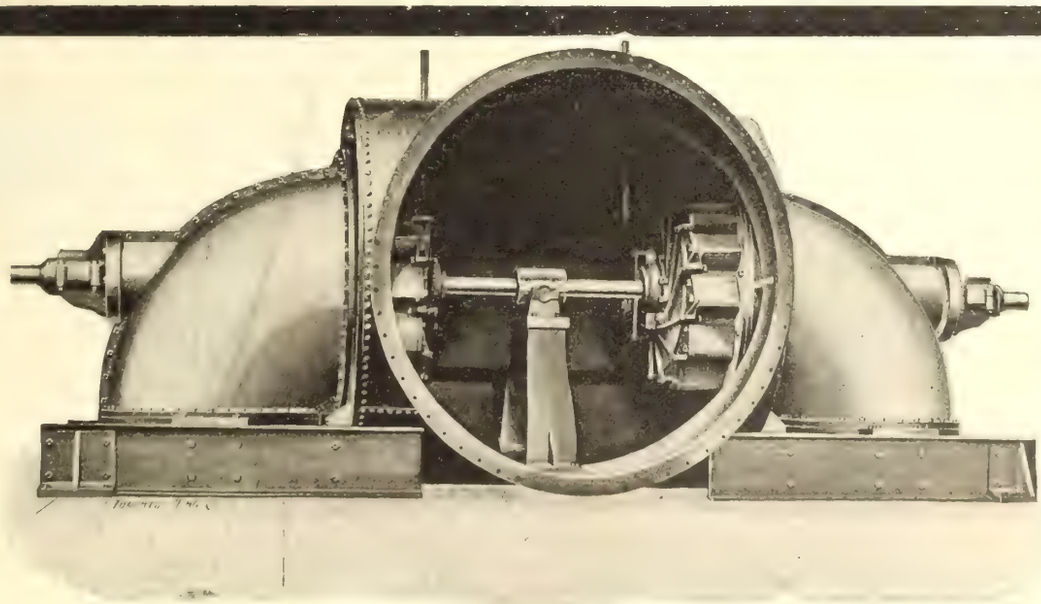


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CANADA.

BRITISH ELECTRICAL MANUFACTURING ENTERPRISE.

From a notice which we publish in our "City Notes" to-day, it will be seen that an important change is being brought about in the well-known Preston concern with which Messrs. Dick, Kerr & Co. have been identified right from its initiation two or three years ago. There is every reason to believe that with their increased capital and under the altered conditions, Messrs. Dick, Kerr & Co. will be in an even stronger position than before. The enterprise which has been displayed by this company during the past few years has given great satisfaction in most electrical circles, and more especially among engineers who have been eager to see our national electrical industrial position improved so as to enable foreign competitors to be successfully beaten by British manufacturers. Our readers will have noted from what has appeared in our columns during the past year or so, how actively the firm's representatives have been engaged in the Colonies, and if what they have done in the past may be regarded —as we believe it may—as an indication of what they are likely to do now that the Colonial development, especially in South Africa, is about to take a leap forward, Preston manufactures will be very much in demand. They have secured a very firm footing in pretty well all important parts of the British Colonies and Dependencies. In the far east they are supplying machinery for Hong Kong ; in Canada the firm has a branch whose propects are very bright ; contracts have been booked recently in South America ; India is also being nursed, and only last week we had occasion to mention the excellent order obtained by them, in the face of the keenest American competition, for the Sydney electric lighting plant. Turning more particularly to South Africa, it should be mentioned that notwithstanding the war, Messrs. Dick, Kerr & Co. have been engaged upon the equipment of the Camp's Bay and Cape Town tramways ; have supplied the new generating plant and rolling stock for the Cape electric tramways ; and have furnished the complete generating plant for the Durban Corporation tramways. They are busy with electric plant equipments for several mining companies, and we understand have just made arrangements for vigorously meeting the business which is now coming on in the Rand district. One point of special interest, which we must not overlook, is the steps they are now taking for developing lines of alternating machinery which will enable them to cope with American and German competition in this branch of manufacture.

Dick Kerr & Co., Limited, have been greatly helped by having the services of Prof. S. H. Short, who has been able, upon the basis of his previous American experience, to obtain results in the design of traction motors and generators which are distinctly in advance of what American makers have been able to arrive at. Prof. Kennedy's report to the London County Council may be quoted as an example in this connection. We understand that there has been no scrap-heap at Preston, and if that be so, Prof. Short is entitled to a great deal of credit when one considers the rush and magnitude of the work there. In discussing the question of American competition, we think it right to draw attention to the unfairness arising from the fact that, though British manufacturers may adequately equip themselves for competition throughout the civilized world, they are debarred from the United States of America by a prohibitory tariff, which, we believe, is 45 per cent. It is easy to see the advantage which this gives to American electrical firms, in reserving for them the largest market in the world, whilst, at the same time, they are free to meet on equal terms British firms in Great Britain, where it is exceedingly difficult to obtain any appreciation of this discrimination. Fortunately, the Colonies show a greater understanding of the vital facts of the case.—Electrical Review.

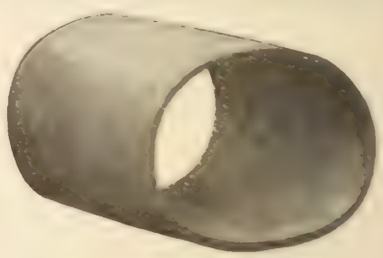
THE NIAGARA POWER DISPUTE.

The Ontario Cabinet has decided to grant the Ontario Power Company's application by authorizing the construction of a cofferdam at Dufferin Islands, on the Niagara River, by the Ontario Power Company, to be used in diverting water through the park to the company's outlet below the falls. The company's application was opposed by the Canadian Niagara Power Company, which was first in the field, and has built a magnificent power tunnel.

The Nova Scotia Telephone Company have in contemplation a direct line from Windsor to Truro, N.S.



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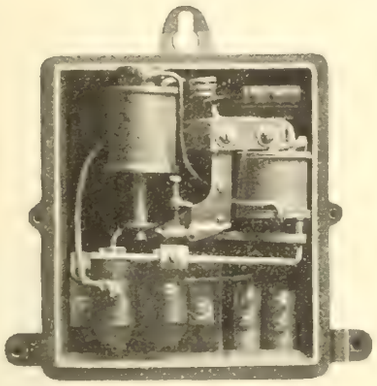
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He cannot use more current than he pays for.

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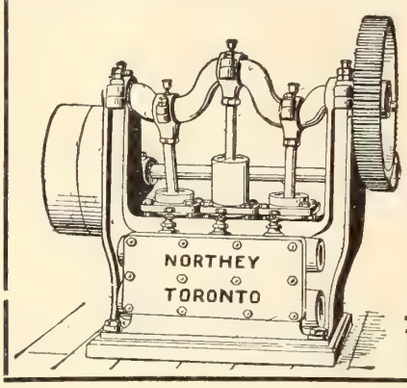
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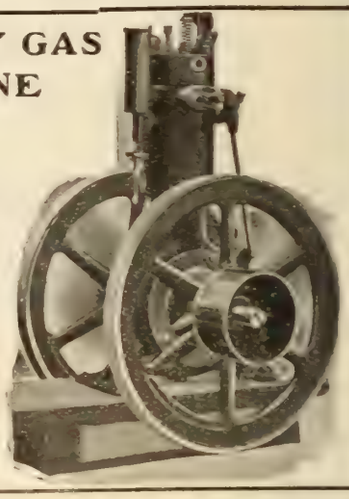
We manufacture pumps of every description—for all purposes. Our pumps are standard in Canada for excellent service.

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The Northey Gasoline Engine offers the best proposition in the market for cheap, easily handled power. The Engine runs with practically no attention—any boy can manage it—running expenses very light. Ready for work on the minute. Suitable for running independent electric light plants—pumping and elevator plants, etc. This cut illustrates the ½ H. P. size—the only vertical style built; all other sizes are horizontal.

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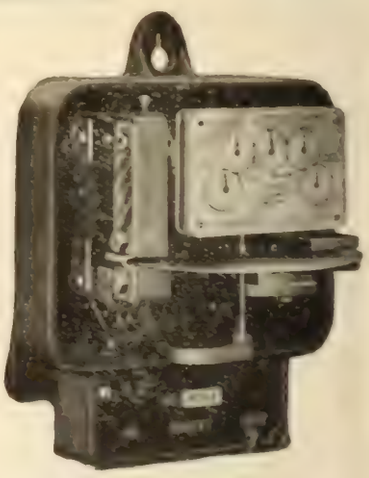
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Is correct on all loads from two per cent. of its capacity to fifty per cent. overload.
Internal losses are practically nothing.
Accuracy maintained.
Simplicity in design.
Firmly constructed.
Dust, insect, moisture and water proof.
Extremely light weight (10 lbs.)
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Reads directly in watt hours.
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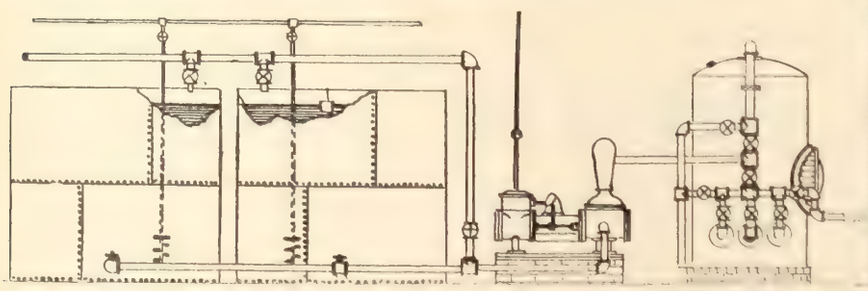


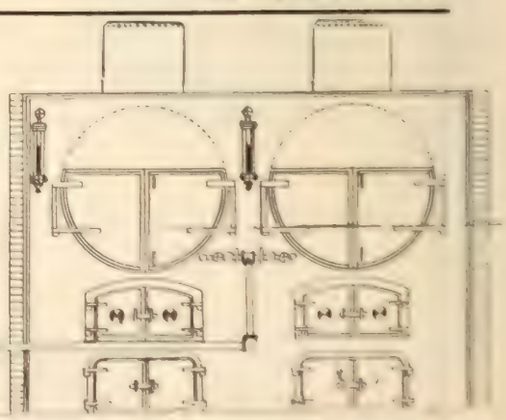
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CANADIAN
ELECTRICAL NEWS
AND
ENGINEERING JOURNAL

VOL. XII. SEPTEMBER, 1902 No. 9.

THE GOLDSTREAM-VICTORIA TRANSMISSION PLANT.

The British Columbia Electric Railway Company, Limited, which has developed the Goldstream-Victoria transmission plant, is a British organization, the directors being R. Horne Payne (chairman), F. S. Barnard, I. Horne Payne, K. C., A. C. Mitchell-Innes, G. B. Norton and Francis Hope, of London, England. Mr. J. Buntzen is general manager, with headquarters at Vancouver. The other officers of the company are R. H. Sperling, general superintendent, Vancouver; A. T. Goward, local manager, Victoria; G. M. Tripp, superintendent, Victoria; H. Gibson, superintendent of traffic, Victoria.

The company operate the electric railway systems in Vancouver, Victoria and Westminster, also the interurban line connecting Vancouver and Westminster. This description will be confined to the Goldstream transmission plant.

Previous to the present company being formed in 1895, the concern was known as the Consolidated Railway Company. The new company finding the steam power inadequate to met the demands, decided to utilize the water power of Goldstream, a mountain stream 13 miles from Victoria. The transmission plant, however, was not completed until 1898.

The water right is controlled by the Esquimalt Water Works Company. They deliver water to the power house gate valves at 285 pounds per square inch. This company has done some very excellent and substantial work, in building dams for three large storage lakes, and a balancing reservoir (see Fig. 1.) The reservoir is at the head of their pipe line, which is 7,920 feet long and 28 inches in diameter, rising to an altitude of 700 feet above the power house. During the wet season the lakes fill to their total capacity, and the storage is ample to tide over the summer months.

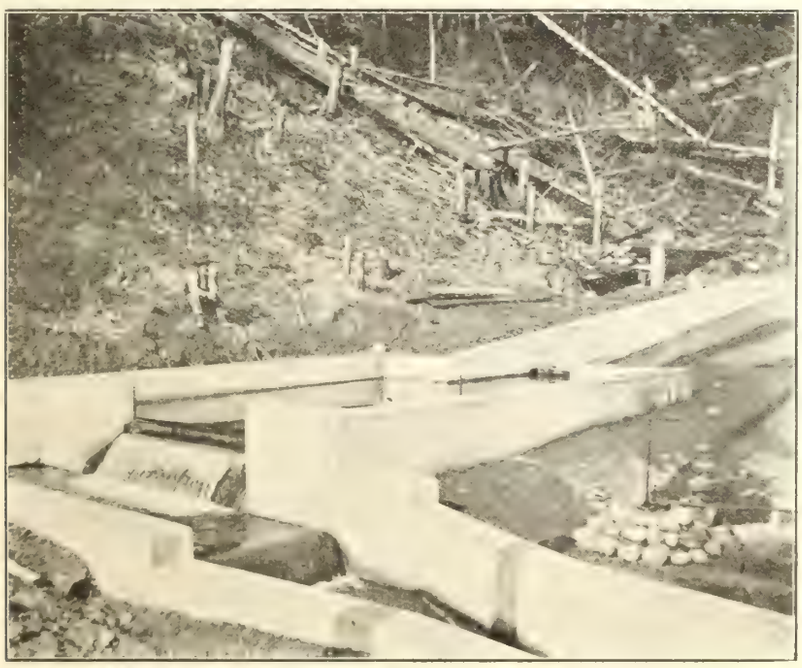


FIG. 1. VIEW OF TAIL RACE, WEIR BASIN AND SPILLWAY.

The power house installation consists of two 600 horse power and one 900 horse power Pelton impulse water wheels (shown in Fig. 3), direct connected to two 360 k. w. and one 500 k. w. 60 cycle three phase Canadian General generators (Fig. 4.) Each machine has its own exciter and governor. The current is generated at 700 volts, after which it is transformed to 17,000 volts for transmission over the line to Victoria. Between each alternator and the set of raising transformers to which it is connected, are one alternating current volt meter (which is so arranged that it can be thrown onto either of the three legs), three ammeters, two integrating wattmeters, and two indicating wattmeters. There is also a switch to connect the machine busbars to the transformer busbars



Fig. 2.—Exterior of Power House.

through a synchronizer. Between the raising transformers and the high tension busbars there are also, for each set of transformers, three single-pole double-throw 20,000 volt switches for connecting to either of the two out-going lines.

The accompanying illustration (Fig. 5) shows the

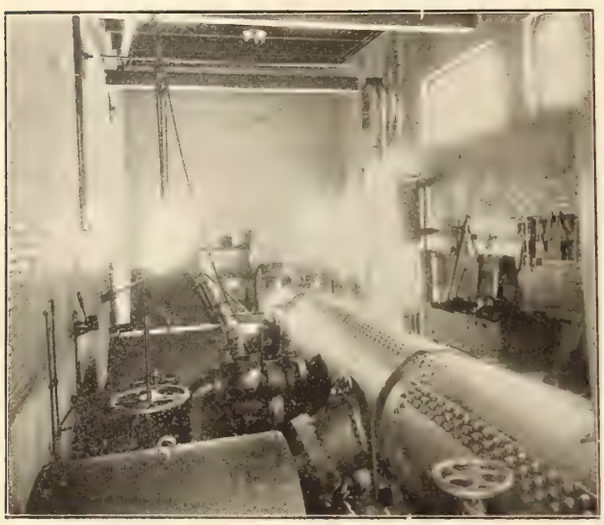


Fig. 3.—Wheel Room, Showing Three Pelton Water Wheels and Receiver.

nine raising transformers in their separate transformer room, together with high tension switches, blowers, and blower motors.

The transmission line consists of six No. 4 B.& S. copper conductors mounted on 22,000 volt insulators. This line is built through a very rough and wooded country, a great number of the trees measuring 200 feet in height, with 5 foot trunks, and to ensure an uninterrupted service it was necessary to clear a right-of-way 300 feet each side of the pole line.

The sub-station in Victoria is equipped with one 300 k. w. 60 cycle three-phase rotary converter and three 125 k. w. lowering transformers. An additional 300 k. w. rotary-converter and four 125 k. w. lowering transformers have been ordered and are now nearly ready for operation. There are also six 125 k. w. lowering transformers for lighting purposes, with an additional four on order. The high tension switches and wiring in sub-station is similar to that at the generating station.

The company have also a reserve steam plant in the sub-station, to be used in case of accident to or failure of the transmission plant.

The company have in operation about 35,000 incan-



Fig. 5.—Step-up Transformers and H. P. Switches.

descent lamps, 50 Nernst, 50 commercial arc, and 100 motors of various sizes connected to their system. The business portion of the city of Victoria is fed from a three-wire secondary distribution using 25 k. w. transformers to lower the voltage from 1040 to 110 and 220 volts. For the outlying districts a primary voltage of 2000 volts is used. The railway consists of fifteen miles of track and twenty cars.

The company recently erected at Victoria a new car shed capable of housing forty cars. It is 240 by 160 feet, of brick, and equipped with all modern improvements. Exterior and interior views are shown in Figs. 7 and 8.



Fig. 4.—Generator Room.

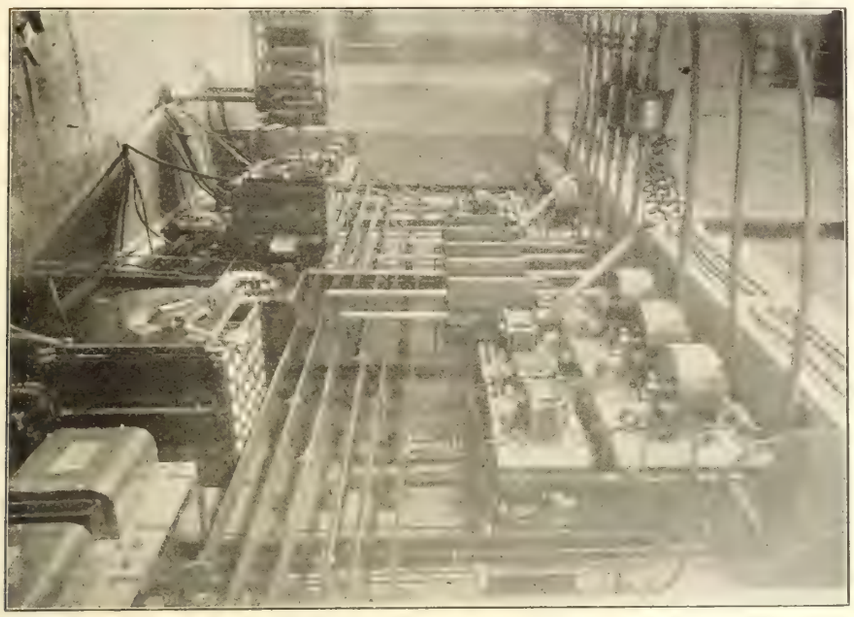


FIG. 6.—BACK OF LOW PRESSURE SWITCH-BOARD.

BEES IN A TELEGRAPH BOX.

A dispatch from Morristown, N. J., says : When A. P. Green, manager of the Postal Telegraph Company at Chester, climbed up to the cable box on top of a 50-foot pole in front of his office he was looking for trouble, but not the kind of trouble which he got. When he opened the box he found there a mass of buzzing bumble bees—"a million of them" is the way he expressed it. A swarm of bees had taken possession of the box and were filling it with wax and honey. Mr. Green slammed the door shut and got down in record time. He immediately reported the matter to headquarters, and now the officials of the telegraph company are trying to get some thick-skinned or fearless man to ascend the pole and fish out the bees and honey, for it is said that they have stuck the Chicago and St. Louis wires together.

TELEGRAPH LINEMEN.

A recent issue of the Toronto Globe contains an interesting sketch of the work of telegraph linemen. The Great North-Western Telegraph Company, it is stated, have over one hundred regular linemen in their employ. This number is largely augmented in the summer season, when the lines are given a general overhauling by the repair gang. The work required may be judged by the extent of wires and territory covered. The Great North-Western Telegraph Company have 18,000 miles of poles, 40,000 miles of wire, with some 1,800 offices throughout Ontario, Quebec, New Brunswick, Manitoba, and a section of British Columbia. The Canadian Pacific Telegraph Company have 42,000 miles of wire in operation in Canada and 1,100 offices. In certain remote localities along the lower St. Lawrence River, and in the North-west Territories, where private companies would hardly be justified in extending their lines, the Dominion Government have in operation somewhere in the neighborhood of 3,600 miles of wire and 184 offices. The total amount of capital invested in Canadian telegraphs may be roughly fixed at between six and seven million dollars, and the total wire mileage at somewhere in the neighborhood of 86,000. In respect of population it can truthfully be said that no country in the world enjoys a more extensive system of telegraphs than Canada. Scarcely a town or hamlet in the whole country but has connection by this means with the outside world.



FIG. 7.—EXTERIOR OF NEW CAR BARN.

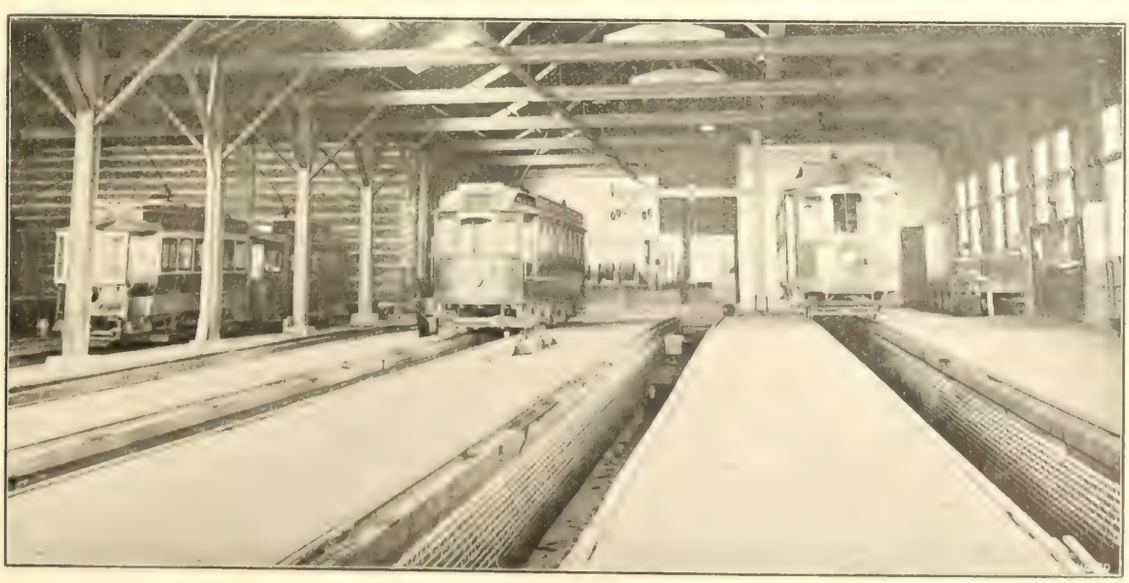


FIG. 8. INTERIOR OF NEW CAR BARN.

CANADIAN ELECTRICAL NEWS AND ENGINEERING JOURNAL

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The Metric System.

FROM the Colonial Conference in London comes word of the resolutions which were passed calling for memorials to be presented to the proper parties in the British Government, requesting that they again take up the question of the Metric System, with the view to its adoption in England at no very distant date. This is the country which has stood out most strongly against a change in its methods and tables of reckoning and measuring, and if the advocates of a decimal system were successful in having it adopted throughout Great Britain, the balance of the world would forthwith follow suit, and with joy. The expenditure necessary to make the change complete would naturally reach into enormous sums, and the time required would extend into several years. In the meantime mistakes and confusion would without doubt be present to an appreciable extent, but on the other hand the benefits derived would come to the portion of everyone in the land; a very minor point, which comes home to all of us who have had occasion to handle English money, is the self evident superiority of the decimal coinage whose advantages we enjoy. Electrical men can further testify to the point when they consider the ease with which electrical power can be reckoned in kilowatts, using the decimal figures of 1,000, as compared with the time honored but nevertheless most inconvenient designation of horse power in watts, where the extremely unhandy number 746 has to be repeatedly used as multiplier and divisor. It is to be hoped that in this and many other proposed changes the work of the Conference will result in the adoption by the Mother Country of those ideas and systems which, while long recommended by other nations, have steadily been objected to by England.

Entrance of Suburban Roads.

APROPOS of the negotiations at present being carried on by the Toronto Railway Company, the City of Toronto and the Metropolitan Railway Company with a view towards settling the terms on which the latter shall enter the city limits, one of the Toronto evening dailies recently devoted part of its space to calling upon the civic officials to protect the city against what, according to it, was likely to be a serious inconvenience, if not positive danger, to all those who use the city highways, namely, a third rail. It was claimed that a third rail would have to be laid wherever the Metropolitan cars were run, as it is a standard gauge road, while that in the city, through some curious mischance, is some two inches wider. While it is the privilege of the press to guard the civic interests, and to lay before the public all things likely to menace its well being, it is one of their first duties to make sure that they do not cry "Wolf, Wolf" where no wolf exists. The difference in the gauges of two inches would not allow of an extra rail being laid, and even if it would the attendant expense would be a most effectual deterrent, seeing that it would be necessary not only to put in the extra rail itself, but that new special work would be required at all intersections and turnouts, a truly serious matter. There are enough genuine obstacles in the way of a settlement, without the introduction of alleged difficulties to hamper matters, and it is to be hoped that all parties to the contract will recognize the great benefits which will accrue to all concerned when the

various suburban lines now stopping at Toronto's gates are successful in arranging for running rights to the centre of the city, and work in harmony to that most desirable end. Toronto is almost alone, even among Canadian cities, in requesting that her citizens be put to the great inconvenience of transferring when they reach her boundaries, while across the border such a bar to the progress of both parties, the city on the one hand and the railways on the other, would not be tolerated for an instant.

Demand for Multiphase Apparatus.

A few years ago all those plants installed for the purpose of lighting the smaller of our cities and towns were equipped, when alternating apparatus was selected, with single phase machinery, but latterly the trend has gradually turned the other way, and multiphase apparatus is coming more and more to the front. The present indications are that this movement will continue until the former will become almost obsolete. This change in practice is due to several courses ; in the first place alternating plants which but a very short time past installed a single phase equipment, saying that their business was lighting and that no motor load was visible, are to-day bemoaning their inability to carry the day load of motors which has so quickly sprung into existence and is offering itself. "Once bitten twice shy" is an old adage, and based on it multiphase machinery is being installed to-day for lighting work only ; if a motor business can later on be worked up, the apparatus is in the power house ready, without any changes whatever, to drive it. Again, recent improvements in various methods of compounding alternating current generators, compensating not only for a difference in actual current output, but also for the changes in the character of that output, that is, variations in the power factor of the load, which are inseparable from motor circuits, have made it comparatively easy, compared to what it was in the earlier stages of motor work, to maintain a steady line voltage, and has thus removed one of the greatest objections to the serving of both lighting and power from one set of bus bars. There is also another point to be considered, and that is that either a two or three phase machine can be loaded on one phase only to 70 or 80 per cent. of its total output, and the heating be no greater than if it were fully loaded, each phase with its proper share. The natural query is, why should one buy a 100 k.w. two or three phase machine when one of 70 or 80 k. w. single phase will carry the load, and the answer is : Owing to several well-known electrical laws, a given weight of copper and iron will, with the same heating, give 20 to 25 per cent. more output if wound multiphase than if single phase only, or in other words, a 100 k. w. multiphaser costs little if anything more than a single phaser of 70 or 80 k. w. capacity. Obviously the first machine, capable of equalling the latter in the latter's field, and of outstripping it in its own, is much the preferable one of the two.

Consulting Engineers

The Canadian field for the consulting electrical engineer is gradually widening; especially is this the case in the past few years, as water powers but a short time ago considered almost valueless have been one after the other developed and have proved good investments, but there is a regrettable tendency among many of our financial men to send across the border when in need of technical assistance. Surely this is a state of affairs not only much to be regretted, but one which a little reflection will show is quite unwarranted. There are a number of men in Canada who are in every way the peers of those across the line to whom much of the business goes. The men putting in electrical plants and hoping for a revenue from the profitable sale of their product, electric light and power, are dependent for their success upon the ability of their customers to in turn profitably dispose of their goods ; why should they not give an example by spending their money in their own land, buying their engineering advice at home. The cry is often heard, "our men have not had the necessary experience." How are they going to get it if they are not given the chance? The argument savors too much of the system of condemnation first, the trial to follow. The matter does not end at this point either ; if the erecting engineer come from our neighbors, the chances are that much, if not all, of the apparatus will be imported, and thus the Canadian trade gets another set-back. To the consulting engineers a word might be said. Their duties lie not so much in preparing a specification very minute in some details and slurring over some of the large and most important items, but in going over the local field and advising their clients the system and plant most suited to their requirements, the specifications being but little more than a statement or outline of the items required and the duties to be performed. The designing and manufacturing engineers are the ones to enumerate the guarantees and other details of the equipment they propose to furnish, the consulting engineer advising the purchaser on the true merits of the various points brought forward by each tenderer, and finally, after the contract has been awarded and the plant installed, making clear to all parties that the successful bidder has faithfully performed the terms of the agreement. Too often one sees great stress laid on a difference of one per cent. in the full load efficiency of a generator, when, taking into consideration those of the boiler and engine, or the water wheel, and the belting and shafting, the difference in the resultant plant efficiency is utterly and entirely negligible.

OUR BRITISH OFFICE.

Owing to increased British business, the publishers of the Canadian Electrical News have established a branch office at 22 Great St. Helen's, London, E. C. Persons interested in the electrical industry are requested to avail themselves of the facilities thus afforded for securing information regarding the Canadian market. Our representative will be pleased to call personally in response to a request. Address, The C. H. Mortimer Publisihng Company, 22 Great St. Helen's, London, E. C.

LIGHTNING AND SYNCHRONOUS APPARATUS.

In answer to a query sent out by the National Electric Light Association as to what effect lightning will have on synchronous apparatus operated from transmission lines, Mr. C. O. Burrows, of Walla Walla, Wash., communicated that with single-phase apparatus lightning always causes step to be broken and generally burns out one or more coils of the generator. As a consequence of this the Walla Walla Gas and Electric Company has discarded single-phase synchronous apparatus.

QUESTIONS AND ANSWERS

"R. T." writes: Can you give me a receipt for making a black finish on brass articles, something that is easy to apply?

ANS.—Make a strong solution of nitrate of silver, and another of nitrate of copper, not quite so dense. Mix the two in about equal proportions and dip the articles in. Leave them there for a short time only, then heat until the desired degree of blackness is attained.

"Student," Montreal: What are the different voltages to be obtained from three transformers, on a three phase system, if I connect the primaries and secondaries in the different combinations of delta and Y? the primary voltage is 1,040, secondary 104.

ANS.—With primary and secondary both delta or both Y, the secondary voltage will in both cases be the same, namely 104; with primaries Y and secondaries delta the voltage is $\frac{1}{\sqrt{3}} \times \frac{104}{} = 60.4$ volts; if the former be made delta and the latter Y the equation is then $\sqrt{3} \times 104 = 180.1$. When the primary windings are connected delta, the combined capacity of the three transformers is three times that of one, but when they are connected Y, the line voltage remaining unchanged, their capacity is but $\frac{1}{\sqrt{3}}$ or .577 times that of what it was before, these capacities being unaffected by the connections of the secondaries.

C. I. F. Marckton, St. Andrew, Scotland, writes: "I should esteem it a great favour if you could supply me with any information with regard to the insulation of 100 to 3000 volt aerial lines as used in Canadian towns and suburban towns. If any tests, especially life tests, on these lines have been made I should be glad to be able to obtain these. I should also be glad to have copies of the rules, if any, corresponding to the Board of Trade regulations in England."

ANS.—Canadian practice for the insulation of all voltages up to the highest you specify is to use weatherproof insulated wire mounted upon a double grooved double petticoat insulator made of glass, about four inches high, and three inches in diameter at its widest point, the pin, which is of oak, holding the lowest edge about 1½ inches from the cross-arm. We do not know of any life tests having been conducted, but it can be said that in most cases all the materials with the exception of the insulation on the wire will last until removed to make way for lines of larger capacity or a different location. Exceptions to the above would be cases where the line runs over open country, in which case the wire would most probably be bare; further, where heavy conductors such as 4/0 B. & S. cable or larger are used, it is often considered advisable to install a somewhat larger and stronger insulator, shaped to accommodate conductors of larger diameter. We are forwarding you two copies of the National Electric Code, being the rules governing the installation of electric apparatus as recommended by the National Underwriters' Association of the States and adopted by the Canadian Underwriters' Association. You will find in it detailed specifications for weatherproof wire. No 1902 edition of the Code has been issued, that issued last year being adopted in toto for this season also.

R. E. Smith writes: We have removed the armature of our 250 volt power generator for repairs, and have just got it finished, but it will not excite itself; can you tell me how to find out what is the matter?

ANS.—The trouble probably consists either in a cross in the winding or in having the wires connected to the commutator in a direction opposite to what they were before. We would suggest that you connect the two field coils, or if it is a multipolar machine, the two halves of the field, in parellel, then if a short circuit exists in the armature winding it will almost certainly show itself by heating of the coil concerned or by the burning out of the cross. If no trouble manifests itself when the machine is run in this manner, and it still refuses to generate, reverse the field connections, that is, interchange them on the brush holders. It is now practically certain that the generator will excite, after which the field coil connections can be restored to their original relations with respect to each other, leaving them reversed on the armature. If the machine is compound wound it will be necessary to reverse the series fields also.

"J. H.," Victoria, B.C.: Explain what is meant by working steam expansively, as in a steam engine.

ANS.—Steam is a water vapour or water gas, and may be taken, as far as this question is concerned, to have the properties of a perfect gas. Its properties will therefore vary inversely as its volume, and consequently if it is at a high pressure it will be capable of expanding until it has the same pressure as the atmosphere, if a vaccum is provided by means of a condenser, and by thus expanding it will be able to do work. To explain as clearly as possible what is meant by working steam expansively, as in a steam engine, take first an engine working with full steam pressure the whole length of the stroke. Then the work done per stroke is the pressure of steam on the piston in pounds multiplied by the length of the stroke in feet, and the steam is exhausted at nearly the same pressure as it enters the cylinder. Now, take an engine using steam expansively. The full pressure of steam is on for part of the stroke, and the work done for this part of the stroke will be the pressure of steam on the piston in pounds multiplied by the length of this part of the stroke in feet. The steam is then cut off, and the steam in the cylinder, instead of being exhausted at this point, is allowed to do more work by expanding and thus driving the piston the remainder of the stroke, and the steam is then exhaused at a much lower pressue than it entered the cylinder. It will thus be plainly understood that by working steam expansively you do not get the same amount of work out of an engine as if the steam was on full pressure the whole length of the stroke, but the amount of work got out of the same amount of steam is considerably greater. Thus less steam is required to do the same amount of work, and there is consequently a saving in fuel.

The Midland, Ont., Electric Light Company, have been offered $8,000 by the town for the purchase of their plant.

DEVELOPMENT OF ARC LIGHTING APPARATUS FROM 1810 TO 1902.

By W. D'A. Ryan.

We will devote this evening to a review of Arc Lamp Development from 1810 to 1902, with a general consideration of Modern Arc Lamp Engineering. It will be quite impossible to do justice to such an exhaustive subject in a single evening's discourse, but I will attempt in a very general way, to touch upon a few of the most important points of development in the art, with a brief reference to limitations in modern design.

The year of 1800 marked the beginning of an era of unparalleled discovery and invention and is most memorable in the annals of Science.

It was in this year that Alexander Volta, Professor of Natural Philosophy at the University of Pavia, constructed the first Thermo-pile from which feeble currents of electricity were obtained.

Precisely 100 years ago this eminent scientist and philosopher produced the first flashes of electric light. His generating apparatus was not of sufficient power, however, to form more than a mere spark.

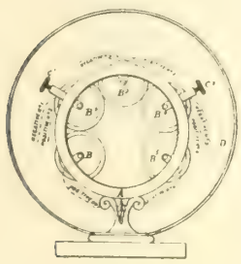
In 1810 he succeeded in forming a three inch arc. The current was obtained from a battery of 2,000 cells, which was installed at the Royal Institute about 1808.

The arc was established between two small pencils of vegetable carbon, commonly known as charcoal.

Sir Humphrey Davy was a man of pure science and he made no attempt at a pract cal application of his discovery, preferring to devote all his time to further scientific research.

While the famous experiment was repeated from time to time in various laboratories, many years passed before a practical application of the discovery was attempted; in fact, nothing worthy of note was done in this direction until after the invention of the Grove battery in 1836 and the Bunsen battery in 1842.

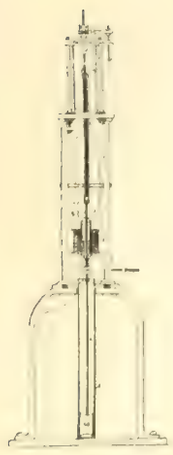
These chemical generators of electricity produced sufficient current to maintain a light for a considerable time, and the subject of electric illumination immediately merged from mere scientific interest to a matter of practical application, and from 1840 to 1860 many patents for arc lamps were taken out.



Wright.

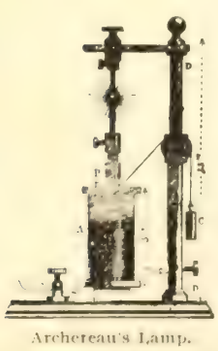
The earliest forms of lamps mentioned are the Duboscq and the Foucault. These were wonderfully sensitive and delicate and were never used outside the laboratory.

In 1845 Wright, of England, took out the first arc lamp patent. His lamp consisted of five disks of carbon which were rotated by clockwork, the arc being established by hand screws. It was a mere laboratory toy and had no practical value.



Staite.

In 1847 Staite patented a lamp in which the carbons were arranged vertically and the feed was governed by the strength of the current traversing the circuit.

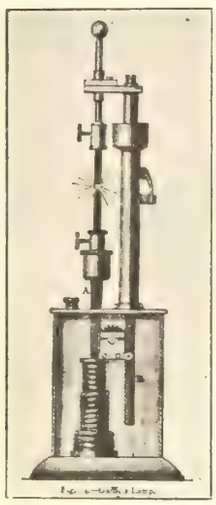


Archereau's Lamp.

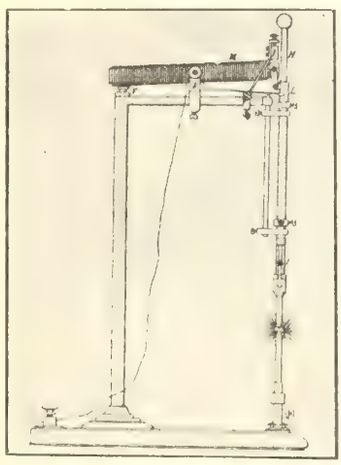
In 1848 Archereau of Paris produced a lamp having a soldnoid magnet. This lamp burned about 1½ hours.

The following year Le Molt of France designed an improvement on the Wright Lamp. In his patent he claimed the means of rotating two disks of carbon and varying the distance between their peripheries. In the Wright lamp there was no means of the latter regulation. Le Molt also claimed the use of all kinds of carbonized material, especially gas retort coke, which was found to be greatly superior on the point of life and homogeneity to the vegetable carbon used by Sir Humphrey Davy.

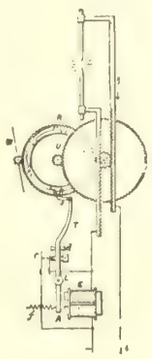
* Paper read at Twelfth Convention of Canadian Electrical Association, Quebec, June, 1902.



In 1850 Gaiffe focusing lamp was introduced. The carbons were held together by a coiled spring instead of a weight as in the Archereau lamp. It burned about three hours on one carboning.

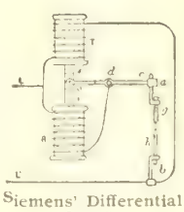


In 1852 M. J. Roberts of England patented a curious type of lamp which picked up against a stop and fed only on the interruption of the arc.

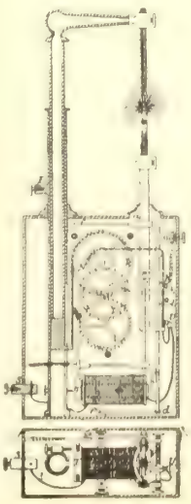


Siemens' Lamp.

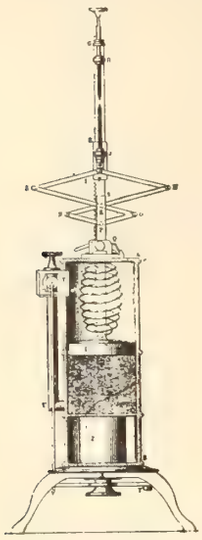
Three years later (1855) Siemens patented a differential-rack focusing lamp. He also introduced a differential solenoid lamp free from gear trains and rack rods.



Siemens' Differential Lamp.



In 1857 Serrin took out his first patent on a magnetically controlled clockwork focusing lamp which had a life of about 3½ hours.



Margais and Duboscq.

In 1858 Margais & Duboscq introduced an arrangement which was ingenious rather than practical. An electro-magnet is located in the lower part of the lamp, where it acts upon a piston-armature floated in a cylinder of oil. The feed is affected by the attraction of the magnet for the iron float, which gives motion to a lazy-tongs carrying the negative carbon.

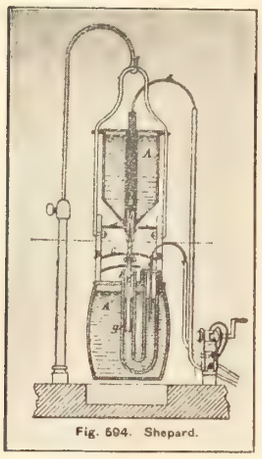


Fig. 594. Shepard.

During the same year (1858) E. C. Shepard of Westminister patented a so-called incandescent arc with mercury float control. The tubes carrying the mercury were cooled by a water jacket. This lamp has no practical value and I show it merely as an illustration of one of the peculiar types of early development.



Serrin (Suisse Model)

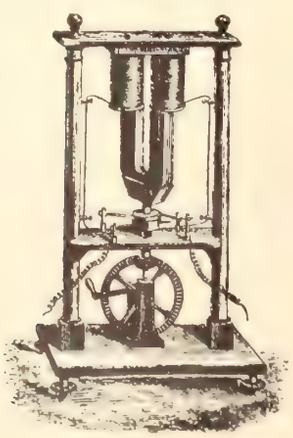
In 1859 Serrin improved his design of 1857 and brought out the 'Suisse Model', having a life of 12 to 16 hours, as compared to 3½ hours in the earlier lamp.

About this time inventors concluded that arc lighting did not have an extended field of operation principally owing to the many disadvantages and high cost of generating electricity by batteries.

During the period of repose which lasted 17 years the Suisse Model of the Serrin lamp was practically the only one which maintained an existence across the interval.

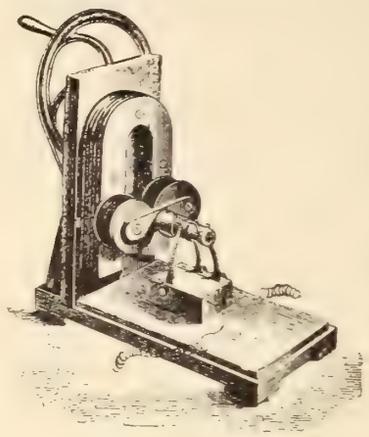
I will now take advantage of this period of inactivity to drop back a few years and review the discoveries and development which lead up to the generation of electricity from magnetism.

In July 1820 Oersted, a Dane, showed that a magnetic needle was affected by the proximity of an electric current. This was followed by Ampere and Arago, who demonstrated more clearly the counteraction between them. It remained, however, for Faraday, following in their wake, to show that a magnet would create an electric current by approach or retrogression from a bar of soft iron having wound around it a number of turns of insulated wire.



Pixii 1832

In 1832, the year following Faraday's discovery, Hyppolite Pixii, at the Academy of Science, Paris, produced what was essentially the first attempt at moulding Faraday's discovery into such shape as to fulfill the requirements of practical application. This machine consisted of two spools of wire suspended from a suitable frame, and a permanent horse-shoe magnet mounted so that its poles could be revolved rapidly past the ends of the spools. A small two part commutator was attached to the shaft, which rectified the alternating current generated in the spools to a pulsating current flowing in one direction.

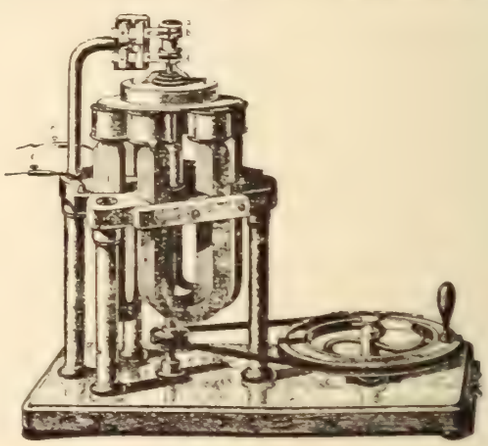


Clarke.

In 1834 and 1836 Pixii's machine was further improved by Saxton and also by Clarke, a magnetic instrument maker of London. In both these machines the armatures were made to revolve, while the magnet remained stationary.

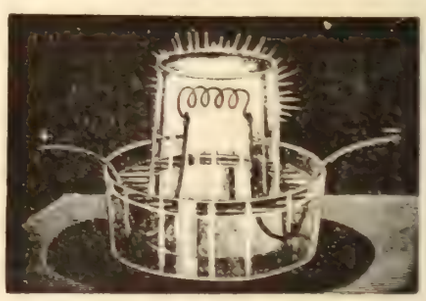
Saxton gave his machine a horizontal position, while Clarke's, as shown by the cut, was arranged vertically. The principle, however, is identical.

The next step in advance was the development of the first multipolar machine constructed in 1844 by Stohrer of Lupzig. It occurred to him that if one magnet and two spools would produce a certain amount of electricity, four magnets and six spools should produce three times as much. His reasoning was vertified.



Stohrer.

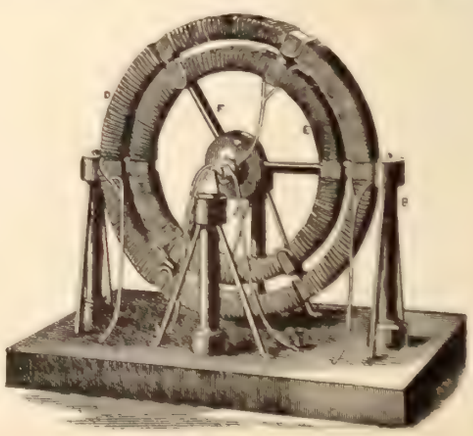
As a matter of general interest I show a cut of the first incandescent lamp constructed in 1840 by Grove. It consisted essentially of a platinum wire attached to suitable terminals.



Grove's Incandescent Lamp of 1840

This was inserted in an ordinary tumbler inverted in a basin of water. The heat of the wire forced the air out and the platinum then glowed in partial vacuum.

In 1842 Elias, of Amsterdam, constructed an electric motor which consisted of a number of turns of insulated wire wound



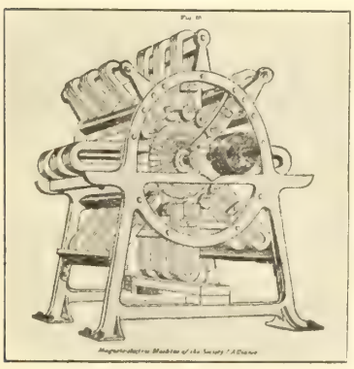
Elias

around iron rings having slightly projecting poles equally spaced around their circumference. Into each of these coils the current was carried from separate batteries, which resulted in rotation of the inner ring.

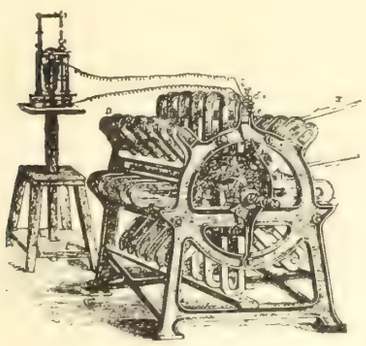
Elias evidently did not carry his investigations far enough to know that the current could be put into the two coils from a single source with the same result; further, had he connected the coils on both the rings in series and then applied power to rotate the centre ring, he would have discovered the principle of the self exciting electro-magnetic machine, which was presented by Siemens, Wheatstone, Varley and others, twenty-five years later.

I venture to suggest that if Elias had been more persevering in his investigations a long period of inactivity would in all probability never have occurred, and it is difficult to theorize on the possible condition of present development if so many years had not been practically lost.

Little of note was attempted from this period until 1849, when L'Abbe Nollet, Professor of Natural Philosophy at the military school at Brussels, reviewing results obtained by Stohrer with his multipolar machine, perceived that by carrying the multipolar feature further, very powerful currents would be obtained, the ultimate object he had in mind being the decomposition of water, so as to produce gas for use in the oxygen-hydrogen lime light. The idea of using electric current directly from these machines for lighting did not seem to be considered at this time.



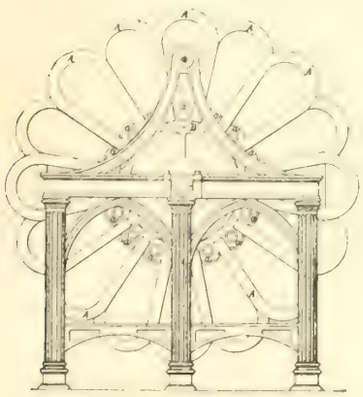
Six of these machines were made in 1853 and taken to Paris for public trial. The illuminating gas bubble proved a ridiculous failure, and the question then arose as to what to do with the machine.



The Alliance Magneto-Electric Machine.

Holmes, who was present at the trial, suggested that they be utilized for the production of electric light, and he adapted the machines to this purpose, and two weeks later he operated from one of these machines an old form of Buboscq lamp.

The following year Holmes designed a machine expressly for the production of electric light. This was given a public trial in 1857.



Faraday was present on the occasion and was so pleased with the outcome of his own discovery that he exclaimed to Holmes: "It is my baby, you know, but you have made a man of my infant."

This growth to man's estate had taken over a quarter of a century.

In 1860 Paccinotti, of Florence, brought out an interesting machine having an annular core on which a number of coils connected in series were wound. This was rapidly revolved in a bipolar field. His writings concerning this machine are not clear and it is difficult to interpret his claims, but the machine certainly bears a close resemblance to apparatus invented by Gramme, a number of years later.

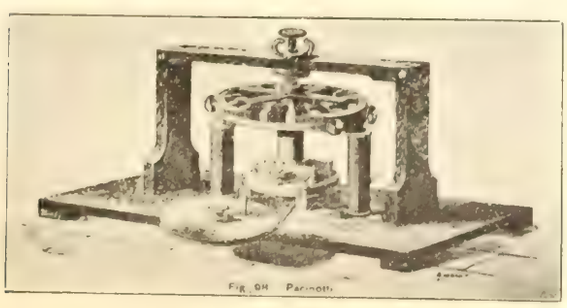
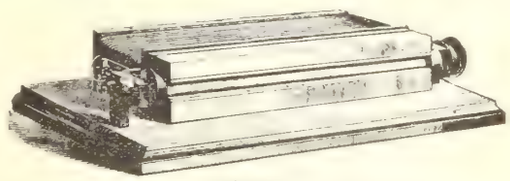


Fig. 9H Paccinotti.

In 1867 Werner Siemens, of Berlin, introduced a self-exciting machine. Siemens, Wheatstone and Varley appeared to have

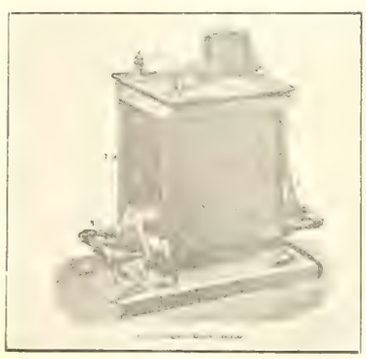


Siemens.

made this discovery simultaneously, in fact, Siemens and Wheatstoue each announced the principle before the Royal Society on the same evening.

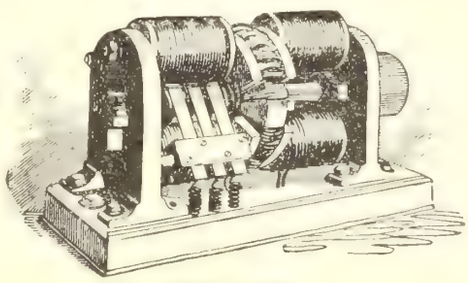
While Siemens is generally recognized as the originator of the ideea, priority is claimed by Moses G. Farmer, of Salem, Massachusetts, who applied for a patent in 1873, which was granted in 1875, and his patent is clearly an anticipation of those described by Siemens & Wheatstone in 1867.

It seems that the secret was suggested to Farmer in 1860, by a friend who described his invention made many years previous, and which he called a cascade or cataract magneto-electrical machine.

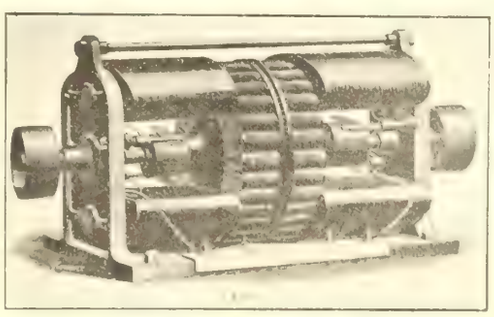


The discovery, to whomever it belongs, at once did away with the objectionable and cumbersome permanent magnet, and a machine for a given output could be made very much more compact and lighter. Such apparatus is called dynamo-electrical machines, indicating that dynamical force is converted into electricity in contra-distinction to the magneto machines, excited by permanent magnets.

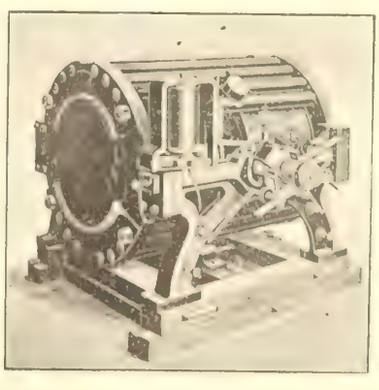
This great discovery was immediately followed by wonderful machine development and a fresh impetus was given to arc lamp construction, and from this period up to the present date work on both machines and lamps has been carried on without intermission.



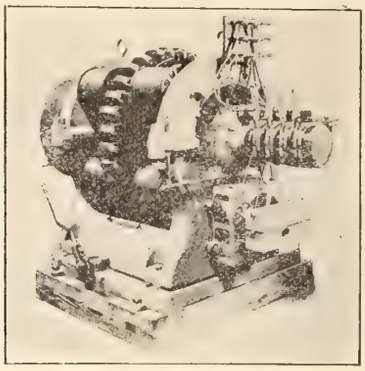
Brush.



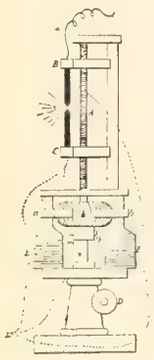
Wallace Farmer (Duplex).



Thomson-Houston.



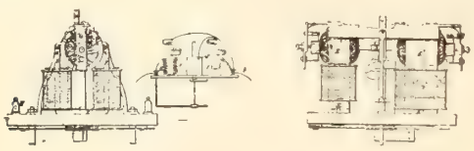
(Modern) Brush.



Tchikoleff.

In 1874 Tchikoleff, Chief of Electric Lighting Service of the Russian Artillery, introduced a differential motor lamp with right and left hand screw. This was followed in 1875 by the Tchikoleff & Kleiber lamp controlled by two motors.

Up to this period no attempt had been made to operate more than one lamp on a machine, so that the idea of having two



Tchikoleff and Kleiber.

electric motors in the lamp mechanism was not nearly so absurd as it would appear to-day.

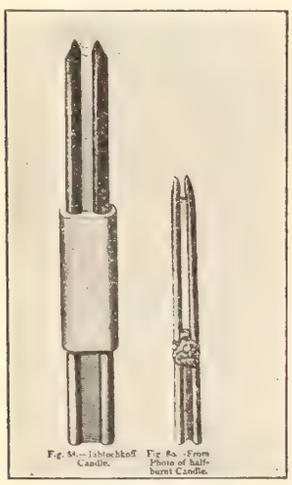
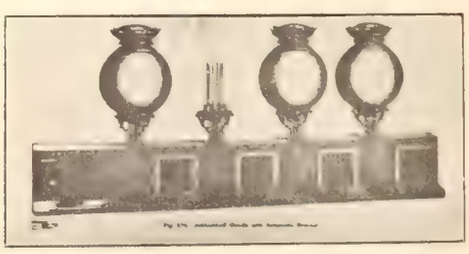


Fig. 81.—Jablochkoff Candle. Fig. 82.—From Photo of half-burnt Candle.

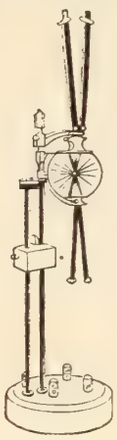
In 1876 Jablochkoff, of the Russian Army, introduced a so-called electric candle which was free from mechanism. This candle consisted of two carbon rods about 3/16" in diameter and five or more inches long, bound together by suitable material and having interposed between them a non-conducting medium, such as plaster of paris. A small block of carbon cemented to the upper ends of the pencils furnished a means of establishing an arc, which burned about 1½ hours before the carbons were consumed. The candle was open to many objections. It could not re-light if it became extinguished, and the light was unsteady and of a noticeable yellowish tinge.

The next slide shows an arrangement of Jablochkoff candles with automatic bracket brought out in 1878. This it will be noted was an attempt to secure life sufficient to burn one night.

Each receptacle contained six carbon couples. As one set



burned out another set was automatically cut in. The apparatus necessary to keep these lamps operating while external to the lamp itself, was of considerable bulk and quite as complicated as the mechanism of some forms of self-contained lamps.



Rapieffe's Lamp.

In 1877 Rapieffe of London patented lamps which could be run six or eight in series. These were installed in the "Times office," London. A suitable cut-out was provided which automatically cut in a resistance when the arc went out.

The lamp has four carbons so that it can be re-trimmed without causing the arc to become extinguished. This might have been useful for lighthouse work, but I can see no other application. The arc was very short and unsteady, in fact, all the earlier arcs were about 30 volts, which is not beyond the hissing point, particularly with the poor non-homogeneous grade of carbons used in the earlier days.

In 1878 Wilde, of Manchester, introduced a candle which was an improvement over the Jablochkoff inasmuch as he did not use insulating material between the carbon pencils, and the

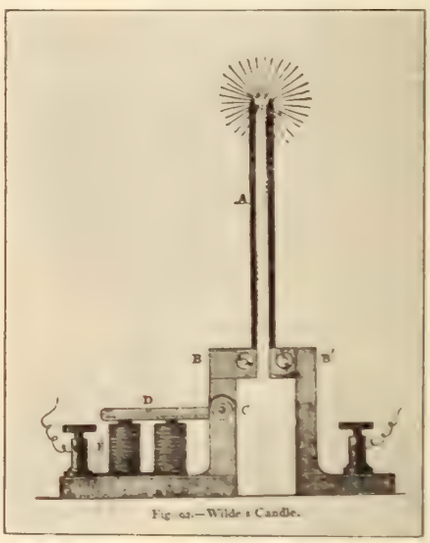
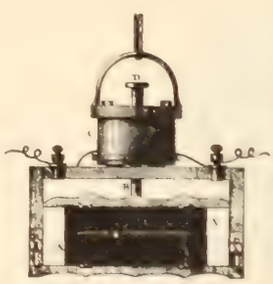


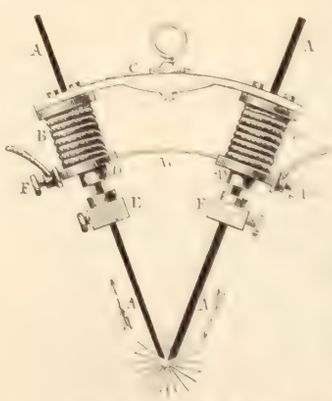
Fig. 92.—Wilde's Candle.

candle would automatically re-light if it became extinguished. While the light from this candle was an improvement over the Jablochkoff, still it was open to the same disadvantage of short life and unsteadiness.



The Wallace-Farmer Lamp.

In the same year (1878) Wallace Farmer patented the earliest attempt at a long burning open arc lamp. He used carbon plates in place of pencils and lamps were arranged so that they could be burned six or eight in series, the current being supplied by Wallace-Farmer Duplex Machines. The principal disadvantage of such a lamp is the enormous shadows cast by the lower carbon and the fluctuation and flickering of light as it travels between the plates; furthermore, the surface of the carbon is so great in proportion to the size of the crater that the heat is conducted away by the mass of carbon and the size and temperature of the crater is lowered so that the light giving efficiency is very materially reduced.



Urquhart's Lamp. End

Urquhart brought out in the same year a plate carbon lamp of radically different construction, the carbons being arranged obliquely and the arc playing horizontally between their lower ends. While this arrangement overcame the shadow objection to a considerable extent the light was more or less unsteady and the efficiency low on account of the heat conduction through the great mass of carbon. The lamp was designed to burn 100 hours, but it was necessary to re-adjust the carbons after the lamp had burned about 10 or 12 hours, thus practically destroying the long burning feature.

(To be continued.)

EXHIBITS AT THE TORONTO INDUSTRIAL EXHIBITION.

The display in the Machinery Hall at the Toronto Industrial Exhibition now in progress is about up to the average of recent years. Considering the conditions under which the exhibits were prepared, they are quite as good as could be expected. Many manufacturers report a demand for their goods in excess of the output of their factories, and consequently have been unable to give as much attention to exhibition work as they desired. In some cases goods intended for the Exhibition have been sold and immediate shipment requested.

ELECTRICAL APPARATUS.

There are five exhibitors of electrical apparatus. The United Electric Company, of Toronto, exhibit, as last year, a working plant. A two-phase 75 k. w. induction alternator and a 25 k. w. multipolar generator, driven by a 40 h. p. Bell (Seaforth) engine, are operating motors and series arc and incandescent lamps in use throughout the building and grounds. The arc lights supplied are 66 in number. The Machinery Hall is lighted off the induction alternator, which operates in series 20 series arc lamps on a 2,300 volt alternating current circuit. Seven standard types of motors, a switch-board, arc and incandescent lamps and a line of electrical supplies complete the exhibit.

The Gee Electrical Engineering Company, Toronto, make their bow in the Machinery Hall this year for the first time. As a young concern they have a most creditable display, consisting of fourteen machines of different types and voltages, the Gould storage battery, and general supplies. Most of the machines shown have been sold, the Dominion government having purchased a 13½ k.w. generator and a 30 h.p. 110 volt motor to swing and light the trolley bridge at Burlington Canal. Mr. W. Gee, the managing director, states that the business of the company is rapidly expanding, and that the capacity of their factory has not been equal to the demand for their goods.

The Toronto & Hamilton Electric Company have an exhibit of dynamos and motors. They report business good, having booked orders for seven machines during the first week of the Exhibition. They have just placed on the market a line of induction motors.

Dynamos and motors comprise the major part of the exhibit of the Consolidated Electric Company, of Toronto. This company claim that their King Edward motor will effect a saving in current of from 30 to 40 per cent. Their head office is at 11 Court street, Toronto, and their works at St. Catharines.

A 60 h.p. Hardill compound engine operates the machines comprising the exhibit of the Jones & Moore Electric Company, of Toronto. They have a 30 k.w. dynamo supplying current to 551 incandescent lights, located chiefly in the Machinery Hall. Their exhibit is tastefully arranged and a pretty effect given by 136 colored lights. A machine is exhibited for extracting tin from iron, used for advantageously working up scrap tin. It is claimed that this is the first machine of the kind to be manufactured in Canada. They also show a full line of motors from ¼ to 15 h.p., electric heaters, medical batteries, telephones, bells, indicators, and specially designed rheostats for automatic cut-off on over-load.

ENGINES AND ENGINEERS' SUPPLIES.

The Goldie & McCulloch Company, of Galt, Ont., exhibit two engines in operation, one a 150 h. p. Wheelock high speed engine, the other a 60 h. p. Ideal high speed engine. These are driving dynamos and other machines in the Hall. The Ideal engine has been sold to the Wiarton Beet Sugar Company for their electric light plant. The Goldie & McCulloch Company also show several wood-working machines.

The Northey Manufacturing Company, Toronto, have their usual interesting display of gas and gasoline engines and pumping machinery, including their triplex power pumps, for which they report a great demand.

The Bradley, Levy & Weston Machinery Company, of Toronto, exhibit one 50 h. p. and one 25 h. p. Hardill engine, driving wood-working and other machinery. They claim that the Hardill engine, for which they are agents, has given excellent results and is worthy the notice of any one interested in power.

"Dominion" gasoline engines and steam specialties, including the Bundy return trap, are exhibited by the Dominion Motor & Machine Company, 50 Esplanade East, Toronto. Their portable engines range in size from 6 to 14 h.p. and their stationary engines from 3 to 28 h.p.

The Fairbanks Company, of Montreal, exhibit gas and gasoline engines, also in a separate space a full range of their celebrated valves.

The Hamilton Manufacturing Company, 98 Church street, Toronto, have a display of metallic high grade engine and pump packings, "Neverslip" pulley covering, oil filters and general engineers' supplies. They claim to be the only manufacturers of metallic packing in Canada.

The Eureka Mineral Wool and Asbestos Company, Bay street, Toronto, have a splendid exhibit of pipe and boiler covering, engine packings, etc., with a pyramid of their goods in the centre of the space. They show mineral wool before and after being manufactured, which has attracted much attention.

Mr. E. L. Purves is in charge of the Mica Boiler Covering Company, represented in Western Ontario by the Luxfer Prism Company, Toronto. A circular wooden model about eight feet in diameter is covered by the prepared mica, all corrugated but without the canvas covering, while there is an equally good display of the goods ready to be applied to the pipe. Mica covering is manufactured in two classes, one for boiler and cylinder covering and the other for steam and hot and cold water pipes.

The Crown Boiler Compound Company, Toronto, show several barrels of boiler compound.

The Grant Hamilton Oil Company, of Toronto, in conjunction with A. W. Spooner, have a good display of Spooner's copperine, "P.S.A." steam boiler straightway balanced blow-off, Sterling paints in all colors, and a range of specialties.

The James Morrison Company, Toronto, have in their exhibit the J. M. T. injector, throttle valves, swing check valves, Hancock inspirators, etc.

OTHER EXHIBITS.

A full line of shafting and power transmission machinery in operation is exhibited by the Dodge Manufacturing Company, of Toronto. The exhibit includes wood split pulleys, friction clutch pulleys and couplings, Dodge system of rope driving, etc.

The only belting concern represented in the Machinery Hall is D. K. McLaren, of Montreal and Toronto. Mr. C. Bradfield is in charge. The exhibit comprises English oak-tanned belting, card clothing and cotton mill supplies, Lancashire, balata and cotton belting, and belt hooks and appliances in all sizes.

There are three exhibitors of babbitt metal. J. N. Tallman & Sons, of Hamilton, show in addition to babbitt metal, bronze, brass and aluminum castings. The Canada Metal Company, Toronto, have on view ten tons of metal, including lead and block tin pipe, electric battery zincs, babbitt metal, etc. J.T. Wing, of Detroit, confine their display exclusively to their high-speed graphite babbitt metal, of which they make a specialty. Their travelling representative in Canada is Mr. J. F. Birchard.

Roller bearings are exhibited by the Toronto Roller Bearing Company and the Chapman Double Ball Bearing Company. The latter have in operation a cylinder weighing 6,728 pounds, which spins on a Chapman bearing 56 minutes after the power is thrown off, as compared, they claim, with 2½ minutes on a journal bearing.

ENGINEERING and MECHANICS

CANADIAN ASSOCIATION OF STATIONARY ENGINEERS.

THIRTEENTH ANNUAL CONVENTION.

At the thirteenth annual convention of the Canadian Association of Stationary Engineers, which opened in Engineers' Hall, 61 Victoria Street, Toronto, on August 19th, the following dele-



W. OELSCHLAGER, Baden, Ont.,
President Canadian Association of Stationary Engineers.

gates answered the roll call: C. Moseley, Toronto president; W. Oelschlager, Baden, vice-president; A. M. Wickens, Toronto, secretary; G. W. Dawson, Hamilton, treasurer; J. Struthers, Sarnia, door-keeper; N. V. Kuhlman, A. Storer, R. H. Johnston, W. J. Webb, of Toronto No. 1; R. C. Pettigrew and J. Ironsides, of Hamilton No. 2; Walter Inglis, Toronto No. 18; Joseph Ogle, Brantford No. 4; William Jamieson, Dresden No. 8; J. Walker, Berlin No. 9; W. F. Chapman, Brockville No. 15; N. Beam, Waterloo No. 17; G. M. Taylor, Vancouver No. 19; W. D. Hall, Sarnia No. 20; F. Donaldson, Ottawa No. 7.

The delegates were welcomed by R. H. Johnston, president of Toronto No. 1, and J. Huggett, chairman of the Reception Committee, after which the president delivered the following address:

"I have the pleasure to welcome you to this, our thirteenth annual convention. I am sure that in selecting you as delegates to this convention your lodges have selected the best men. I feel sure that great good will be done, and that you will give your best consideration to the various questions that may come up. One question that will be brought before you, is that of affiliating with the International Association of Steam Engineers. I hope that whatever is done in this matter will be for the advancement of the organization. There is another question of much more importance, and that is of getting a license law, or legislation that will better the condition of the engineers and the safety of the public at large. This ought to be discussed thoroughly, with the object of deciding upon some definite plan of procedure at the coming session. During the last year there have been two boiler explosions in Ontario, with three persons killed and thousands of dollars' worth of property destroyed.

"I am pleased to say that since the last convention one new association has been formed, in Rossland, B.C., with a good membership, and I hope that during the coming year more advancement will be made in this regard. This could be done by appointing some brother as organizer. Our membership has slightly increased during the year, and all the lodges are in a prosperous condition. I had hoped that some of the delinquent associations would have been brought into active work again. I think that had I the time to pay a visit to these places I might have had a better report to make. I hope the incoming officers will pay special attention to this. I might say that we have been in communication with several of these lodges. The educational work of the order has been well looked after in all the subordinate lodges. This is, of course, a great benefit to the members. I hope that during the coming year more advancement will be made in this good work. During the year I had the pleasure of visiting Hamilton No. 2, when two-thirds of the members were present, and the business of the lodge was conducted in a satisfactory manner. On the 13th of June I visited Toronto No. 18. In this lodge I found very few members turn out on meeting night, and the work of the lodge was not done very well, owing to the officers of the lodge not being present. Bro. Wickens visited Dresden No. 8, on February 1st. This lodge met in the town council chambers with all the members present. They are fully alive, and they take up all points that are for their own advancement. Also on February 3rd he visited Sarnia No. 20, and found them very comfortably situated in a pleasant room. Nearly all the members were present, and the business was carefully and well conducted. The brothers asked many questions relating to the C.A.S.E."

Standing Committees having been appointed, Secretary Wickens presented his report. He was not able to report an increase in membership, the list now standing at 275. A new association had been formed in Rossland, but he had not been able to get a report, and there was an indebtedness to the Executive for per capita dues. Vancouver No. 19 and Hamilton No. 2 increased their membership during the year. The Educational Committee had issued only two papers, while no report had been received from the Legislative Committee, but the Secretary understood that it was decided to allow the question of a license law to stand over until another session. The secretary stated that he received answers from several associations on the subject of affiliating with labor bodies. He also recommended that at least six instruction papers be issued during the coming year, and that the initiation fees, dues and per capita tax be raised in order to provide more money for advancing the interests of the association.

A report from the Executive Committee on the question of affiliating or amalgamating with other organizations was read. The Standing Committees then reported. The Auditing Committee found a balance on hand of $202.70.

The Good of the Order Committee submitted the following recommendations: 1. That none but a president or past president of a subordinate lodge be eligible for election to the chair of president or vice-president of the executive. 2. That we have the union label put on all our printed matter in future. 3. That the preamble to our constitution be discarded. 4. That the



W. INGLIS, Toronto.
Secretary Canadian Association of Stationary Engineers.

leaflets be continued, and that some one be appointed at a salary to get up the same. 5. That the per capita dues be raised from 50 cents to 60 cents per annum per member. 6. That there be three district deputies appointed, and that said deputies act as organizers in their districts, and visit each lodge at least twice during the year, reporting the proceedings to the executive secretary immediately after each visit. 7. That a strong committee be appointed as a legislation committee for the purpose of adopting means of securing a license law from the Ontario Government, said committee to act in conjunction with the Ontario Association, and all other subordinate associations; also that the

executive treasurer honor their bills to the amount of $75. These recommendations were adopted.

The outcome of the report of the Ways and Means Committee was that the president and secretary were appointed to deal with the Rossland association regarding non-payment of dues, and as to affiliation with the International Union of Steam Engineers, it was decided to retain the identity of the C.A.S.E. for another year at least. Subordinate associations are to be allowed to use their own discretion as to the advisability of affiliating with the Trades and Labor Council.

At the afternoon session Mr. G. V. Lighthall, president of the International Union of Steam Engineers, addressed the convention. He is, naturally, a strong advocate of unionism, and argued that the C.A.S.E. would be taking the proper steps by affiliating with the International Union. He contended that stationary engineers, instead of bettering their positions, were going down grade. He contended for a minimum wage for the engineer of $3 per day of eight hours, while the present scale was $1.85 for 12 hours. That was the goal the International Union was striving for. He advocated arbitration and discouraged strikes.

A. E. Edkins said that while he had not been altogether in sympathy with labor organizations, he believed that the time had come when the engineers should attach themselves to some union body, as by this means they would be given a standing and it would assist them to obtain legislation.

After further discussion it was announced that a moonlight excursion around the city and luncheon at Sunnyside had been arranged for. Messrs. Edkins and Webb, who were leaving the following morning for England, were tendered unanimously the best wishes of the Association.

About one hundred and fifty persons enjoyed the moonlight excursion and luncheon gratuitously provided by the local Association. At Meyer's Cafe, on the Lake Shore road, tables were spread for the party, and after satisfying the inner man, attention turned to the toast list. The speeches were brief, leaving ample time for the excellent programme of songs that had been arranged for. After honoring The King, the toasts and respondents were : "Our Guests," by C. H. Thompson, of the Otis Elevator Company, and G. V. Lighthall ; "Visiting Engineers," W. Oelschlager and J. Ironsides ; "The Executive," C. Moseley and A. M. Wickens ; "Reception Committee," J. Huggett and G. C. Mooring ; "The Press," A. W. Smith, Canadian Engineer, T. S. Young, ELECTRICAL NEWS, and J. Laing, Toronto World. Songs were contributed by Messrs. Donald C. McGregor, LeRoy Kenney, Bert Harvey, George T. Beales, Robert Wilson and Robert Brown. H. S. Fletcher presided at the piano.

General business and election of officers comprised the business of the second day. The question of furnishing instruction papers received much attention, and finally it was left in the hands of the Educational Committee. Opinion was divided as to whether it was advisable to mail the papers to each member direct or send them to the local secretaries for distribution.

The election of officers being reached, A. M. Wickens, secretary, announced that he had decided to retire from office. Mr. Wickens has held the office for many years and given much time and attention to the interests of the Association. The following officers were elected : President, W. Oelschlager, Baden ; Vice-President, H. E. Terry, Toronto ; Treasurer, James Ironsides, Hamilton ; Secretary, Walter Inglis, Toronto ; Conductor, James Struthers, Sarnia ; Doorkeeper, N. Bean, Waterloo.

At the evening session a past-president's jewel was presented to the retiring president, C. Moseley. Officers were installed and the following committees appointed by President Oelschlager.

Educational—A. M. Wickens, G. C. Mooring, H. E. Terry, N. V. Kuhlman and J. Fox.

Legislation—C. Moseley, W. Inglis, A. Storer, W. J. Webb, R. Pettigrew, W. F. Chapman and J. Huggett.

District Deputies, offices which had been abandoned for some time, were appointed as follows : Eastern Section, F. Donaldson, Ottawa ; Western, O. P. St. John, Toronto ; Central, A. E. Edkins, Toronto.

It was decided to hold the next annual convention in Berlin. A grant of $30 was made to the Educational Committee, another of $25 to the secretary, and a small sum of money to the caretaker of Engineers' Hall. The usual votes of thanks were passed, including one to the parties who had extended invitations to visit their plants.

NOTES.

The local committee consisted of Jas. Huggett, chairman, G. C. Mooring, W. J. Webb, J. G. Bain, A. M. Wickens, Jas. Bannon, N. V. Kuhlman, W. H. Johnston, S. Thompson, W. L. Outhwaite, Treasurer, R. H. Johnson, Secretary.

The convention programme was a creditable production, and was accorded a liberal advertising patronage.

The Underfeed Stoker Company gave a handsome pocket-book to the delegates, and the Eureka Mineral Wool Company a neat pen and holder.

Mr. W. Oelschlager, president of the C.A.S.E., is a member of the firm of Oelschlager Bros, of Baden, Ont., engineers and machinists and manufacturers of Corliss engines, wood-working machinery, elevators, etc. Within a short time this firm have built up a splendid business. They have now on order six Corliss engines, two elevators, and six carloads of wood-working machinery. They make Corliss engines from 30 to 100 h. p. Mr. Oelschlager has always taken a deep interest in the success of the C.A.S.E., and the honor now bestowed upon him is well deserved.

Mr. Walter Inglis, the new secretary, joined Toronto No. 18 in 1892. He was financial secretary for two years, and afterwards president of that branch. He comes to his present honor the first year he has attended the convention as a delegate.

METRIC WEIGHTS AND MEASURES.

We reprint from the August number of the American Consular Reports the following list of metric weights and measures :

METRIC WEIGHTS.

Milligram (1-1,000 gram) equals 0.0154 grain.
Centigram (1-100 gram) equal 0.1543 grain.
Decigram (1-10 gram) equals 1.5432 grains.
Gram equals 15,432 grains.
Decagram (10 grams) equals 0.3527 ounce.
Hectogram (100 grams) equals 3.5274 ounces.
Kilogram (1000 grams) equals 2.2046 pounds.
Myriagram (10,000 grams) equals 22.046 pounds.
Quintal (100,000 grams) equals 220.46 pounds.
Millir or tonnea—ton (1,000,000 grams) equals 2,204.6 pounds.

METRIC DRY MEASURES.

Milliliter (1-1,000 liter) equals 0.061 cubic inch.
Centiliter (1-100 liter) equals 0.6102 cubic inch.
Deciliter (1-10 liter) equals 6.1022 cubic inches.
Liter equals 0.908 quart.
Decaliter (10 liters) equals 9.08 quarts.
Hectoliter (100 liters) equals 2.838 bushels.
Kiloliter (1,000 liters) equals 1,308 cubic yards.

METRIC LIQUID MEASURES.

Milliliter (1-1,000 liter) equals 0.038 fluid ounce.
Centiliter (1-100 liter) equals 0.338 fluid ounce.
Deciliter (1-10 liter) equals 0.845 gill.
Liter equals 1,0567 quarts.
Decaliter (10 liters) equals 2.6418 gallons.
Hectoliter (100 liters) equals 26.417 gallons.
Kiloliter (1,000 liters) equals 264.18 gallons.

METRIC MEASURES OF LENGTH.

Millimeter (1-1,000 meter) equals 0.0394 inch.
Centimeter (1-100 meter) equals 0.3937 inch.
Decimeter (1-10 meter) equals 3.937 inches.
Meter equals 39.37 inches.
Decameter (10 meters) equals 393.7 inches.
Hectometer (100 meters) equals 328 feet 1 inch.
Kilometer (1000 meters) equals 0.62137 mile (3,280 ft. 10 in.)
Myriameter 10,000 meters) equals 6.2137 miles.

METRIC SURFACE MEASURES.

Centare (1 square meter) equals 1,550 square inches.
Are (100 square meters) equals 119.6 square yards.
Hectare (10,000 square meters) equals 2.471 acre.

Increased business has compelled the Lindsay Light, Heat & Power Company to duplicate their plant at Lindsay, Ont. Orders have been placed for a new water-wheel, 400 k.w. generator, with switch-boards, transformers, etc., and about 40 miles of No. 4 copper wire. The new plant will mean an addition of about 600 horse-power.

MONTREAL

Branch office of the CANADIAN ELECTRICAL NEWS,
Imperial Building.

MONTREAL, SEPT. 3RD, 1902.

The frequent query "what will I do with my boy" is apt to be asked more often if the public use boys in other trades in the same manner as they do those working their way up practically in electric construction. The call is "why don't you send a man," when possibly for a trifle that were a man sent the next kick would be, "a boy would have done as well." However, if the public only knew that the class of boys employed in the electrical field have got to be smarter somewhat than those in many other trades, they might not be so quick in objecting; at any rate, so long as the firm "stand behind" their work, be their employees with beards or without, the public have no real ground for complaint. The business in itself is so young that it would be a hard matter to pick out many with grey hairs actively engaged therein.

The C.E.A. "standing" committee to wait on the underwriters may as well, to use a slang phrase, "go away back and sit down." They are on the wrong tack so far as Montreal is concerned, and will accomplish nothing that way. So says a contractor who has pretty fair knowledge of the difficulties to be encountered along that line.

The alternating arc lamps are nearly all hung and it is a question if the average citizen who has occasion to use the streets at night has ever noticed the difference from the old direct current ones.

Mr. Geo. H. Hill, lately with the Bell Telephone Company, and pretty well known among the boys, is about to start in business in the manufacture of switches, switch-boards, and similar apparatus. Some well known Montrealers are with Mr. Hill and financially backing the company, which we understand will be incorporated.

The Electrical Contractors' Association take up the question of compulsory inspection at their next meeting. It is understood that the proposition will be on novel lines which, if carried, will go a long way toward solving the question of interior wiring without troubling either Underwriters or City Hall.

Fan motor trade in Montreal this summer has been a flat failure so far, owing to the continuance of cool and rainy weather. Trade in general has been rather quiet during July and part of August, but is picking up and bids fair to be lively in September.

Some are inclined to doubt the soundness of the Shawinigan Company's desire to illuminate the St. Lawrence channel from Quebec to Montreal. But why not? The same scheme to a certain extent is working at the very United States port that Montreal is competing with. The scheme put into operation would be of incalculable benefit to the whole eastern part of the Dominion.

One of the most aggravating happenings, and one which happens very often, is the practice of the United States houses to express a rush order and not rush the invoices. It may be hustling to get the order shipped promptly, but such hustle does us no good when there is no bill to clear the goods from "bond." Our U. S. friends must remember that in spite of their good wishes, this is still a foreign country, and probably likely to remain so for some time unless they change their flag and annex.

Another so-called electric fire at the Mount Royal Club has been satisfactorily accounted for before the Fire Commissioners as being a defective chimney flue. Next? This old joke has been so worked to death now that even the public at large are beginning to appreciate the fun of it. True, with the interior wiring as it used to be, fires were likely to occur, but whether luck or no the fact remains that few, if any, fires have occurred by normal interior voltage. When 2,000 volts potential strikes interior wiring, however, it is a different question, and no matter how carefully the wiring of the building may have been done, something is sure to happen. "Visible defects" in the interior wiring have been pretty well cleaned up in Montreal during the past three years, and things are in fairly good shape. Toronto and Ottawa please copy.

CARE OF INNER GLOBES.

ENCLOSING GLOBE BREAKAGE.— In the more modern systems of arc lighting where the enclosed globe type of arc lamps is being used exclusively, the subject of enclosing globe renewals is an important item of central station maintenance. Upon the condition of the enclosing globe and the joints at the holder and cap depend to a large extent the uniformity and length of the carbon life, which are some of the most important advantages claimed for enclosed arc systems. In order to secure these advantages, however, it is evident that there must not be too free an entrance of air to the enclosing globe, and that renewals of enclosing globes must be made regularly, thus avoiding the continued use of defective globes.

CAUSES OF GLOBE BREAKAGE.— A large percentage of necessary globe breakage can be traced to careless handling. No station manager or superintendent would countenance any evident carelessness of employees resulting in the cracking or breaking of a large number of globes. At the same time, however, a great amount of carelessness does exist, as will be shown by the number of globes having nicks at the top or bottom. These nicks, which are very easily overlooked, shorten the life of the carbon and form an excellent start for a crack when the globe is subjected to heat variation. No globes should be used which do not have perfectly ground edges. In transportation and the operations of cleaning and placing the globe in its holder and underneath its cap, as great an amount of ordinary care should be exercised as in the handling of other equally fragile glassware. Each lamp trimmer should know that no lamp on his circuit has a cracked or nicked globe.

IMPROPER ADJUSTMENT OF LAMPS FOR EXISTING CURRENT CONDITIONS.— The cause of excessive globe destruction due to improper lamp adjustment can be readily seen by an examination of the globes, where effects of large arc watt consumption and excessive heat will be evident. The globes will be found to be sagged on one or all sides, due to softening of the glass, or the glass may be blackened at the top. A globe subjected to this intense heat will not maintain a true surface contract and should not again be used. No attempt should be made to use a lamp on a circuit for which it is not intended. Care should be taken to see that it is properly adjusted for the circuit on which it is to run, and neither the lamp nor its adjustments should be condemned, unless, without question, the circuit conditions are what they are nominally supposed to be. This applies to the current on series circuit, the potential at the lamp terminals on multiple circuits, and the frequency on alternating circuits.

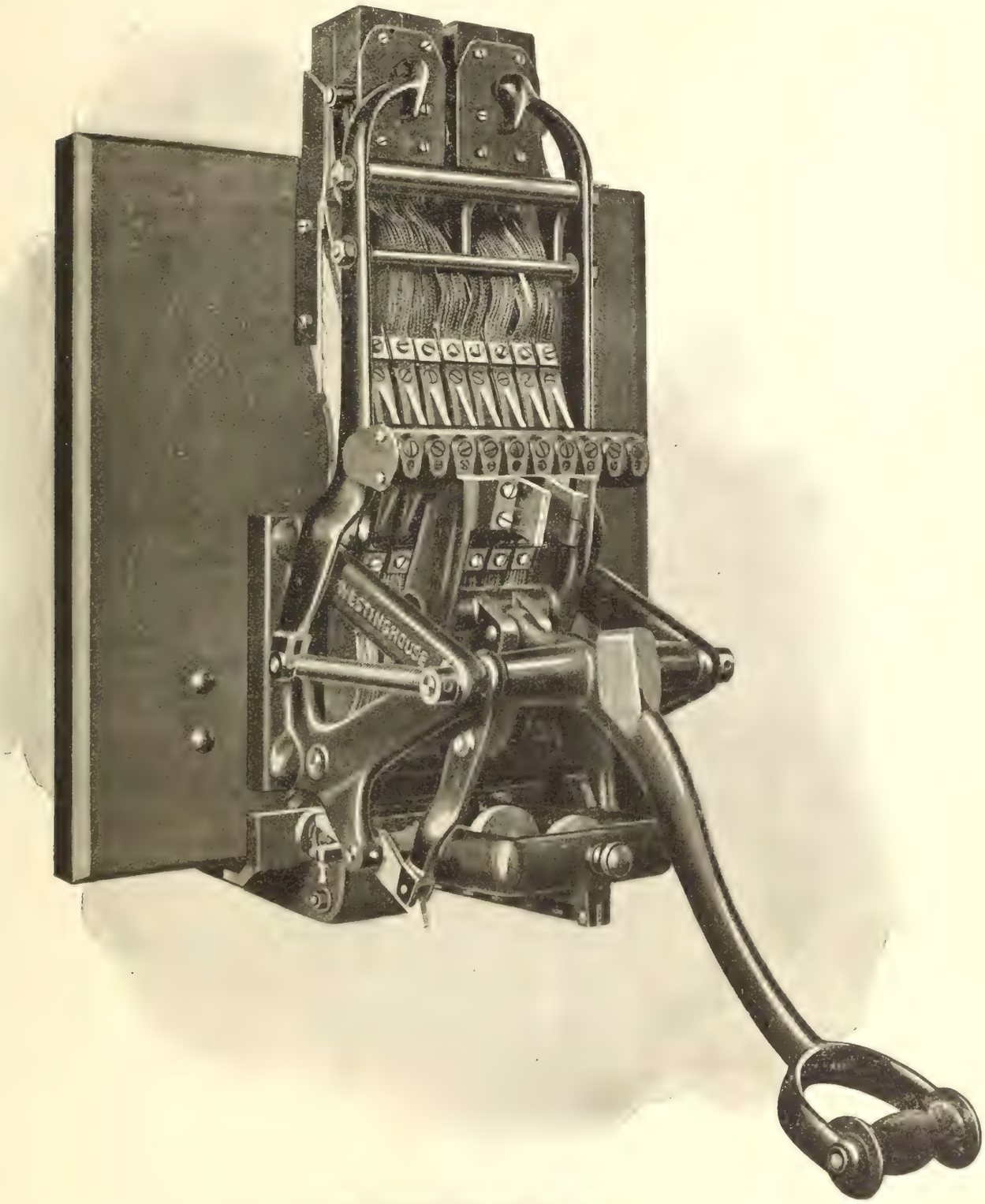
CARELESS TRIMMING.—Results very similar to those caused by high arc voltage may be obtained by the insertion of incorrect lengths of lower carbons, the "too long carbon" causing cracking or melting of the globe near the top, and probably burning the cap and forming a dark reddish deposit on the globe surface; the "too short carbon" causing the melting of the globe at the bottom, and partial or total destruction of the lower carbon holder. Never put in a lower carbon longer or shorter than 5¾.

CLEANING OF ENCLOSING GLOBES.— If an enclosing globe be merely wiped or brushed out at occasional trimmings it soon becomes discolored, due to the deposit being burned into the glass, and an appreciable percentage of light is cut off. The globe must then be either destroyed or cleaned with acid. Repeated use of acid shortens the life of the globe.

METHOD OF TRIMMING.—The very successful method of cleaning enclosing globes, and trimming the lower holders at the station as facilitated by the removable type of enclosing globe holder, is strongly recommended. Having the globes brought into the station at each trimming will give the superintendent an opportunity for securing information regarding the system which otherwise would be very difficult for him to obtain. Here he has the globe and pair of carbons showing the condition of the lamp from which they have been taken. By examining the conditions of these carbons and comparing the length of them a very good idea is obtained both of the individual arc adjustment and the uniformity of arc adjustment of all lamps of the system. Flat and mushroomed ends, together with exceptionally long residue carbons, indicate low arc voltage and short arc; pointed carbons and short residue indicate flaming arc and immediately suggest an abnormal arc voltage or possibly undue entrance of air to the enclosing globe. An examination of the globe may disclose a crack, a nick at the top or bottom, a globe tilting or loose in the holder, or no asbestos washer. Individual cases of short arc and long life might occur from an exceptionally hard pair of carbons or from the core having dropped out of the upper carbon. Again, a pair of very soft carbons might be responsible for the long arc and short life, but generally speaking, a comparison of results during a certain period gives an opportunity for an efficient organization which is sure to produce commercially satisfactory and even gratifying results.—From leaflet issued by Canadian General Electric Company.

LARGE CAPACITY CIRCUIT BREAKER.

The use of very large direct-current generators for railway service and the necessity for securing uninterrupted operation has confronted electrical manufacturers with a difficult and serious problem in the design of circuit breaking devices, as the requirement of such large units exceed all previous undertakings in the amount of power delivered to the system. To handle circuits of this nature transmitting such large amounts of power requires that a general design, both mechanical and electrical, of the circuit breaking devices must be of the highest order to insure the greatest degree of safety and reliability of of operation.



Large Capacity Circuit Breaker.

For the direct-current generators recently constructed by the Westinghouse Electric & Manufacturing Company for the Boston Railway Company, it was necessary to build switchboard apparatus of unusual size, the most notable of which is an automatic circuit breaker. In the accompanying illustration is shown the type of circuit breaker supplied with the above mentioned generators. The normal rating of the breaker being 8000 amperes capacity, places it among the largest circuit breakers yet manufactured. This piece of apparatus is an enlargement of the standard Westinghouse Type "C" circuit breaker.

The Westinghouse Type "C" circuit breaker is of the laminated brush type and is made in 1, 2, 3 and 4 pole combinations, each element of the set being provided with an automatic tripping coil which acts independently of the others or they may be made to operate simultaneously if desired. In general this breaker consists of an upper and lower contact block connected together by laminated copper brushes. Upon these brushes phosphor bronze springs are placed and upon these are the carbon contacts or arcing points; the brushes are held in contact with the cantact blocks by means of a toggle mechanism locked by a trigger attached to the scale beam. (The 8000 ampere breaker has an adjustable range between the limits of 2,000 and 10,000 amperes). To avoid any possibility of arcing at the laminated copper brnshes, woven copper cables are fastened from these brushes to the carbon arcing points.

In operation, the action of the circuit breaker is as follows: The passage of the circuit through the lower stud brushes and upper stud energizes the "U" shaped magnet which attracts the armature. This releases the trigger, unlocking the toggle joint, and copper spring brushes throw the breaker open. In breaking contact, the copper brushes leave the contact block first, aided by the pressure of the brushes which act with the releasing spring instead of against it, followed by the phosphor bronze spring, then the carbon block or arcing point of the out-moving breaker armature separates from its carbon contacts and its circuit is broken. By this method the current is gradually shunted from the carrying brushes to the carbons, thus preventing any arcing from the metal parts of the breaker.

THE BERLIN-BRIDGEPORT ELECTRIC RAILWAY.

The town of Berlin and the village of Bridgeport, Ont., are now connected by an electric railway, thanks to the enterprise of Mr. W. H. Breithaupt. On the opening day early in August an invitation was extended to the Berlin and Waterloo township councils and a number of other persons, a special car conveying the party to Bridgeport, where they were banqueted by the management of the road. In responding to the various toasts, Mr. Breithaupt, the president of the Berlin and Waterloo Street Railway Company and the Berlin and Bridgeport Electric Railway Company, was highly commended for his foresight and enterprise in extending the road to Bridgeport. Ultimately the road is likely to form a belt line to Waterloo.

The line from Berlin to Bridgeport is two and one-quarter miles long, of which about one and one-half miles are on private right of way and the balance on Berlin streets, for which the company has a twenty year franchise. The Grand Trunk Railway is crossed by an overhead bridge, the steepest grade on the approaches to which is about three per cent. Otherwise most of the grades are one and one-half and two per cent.

The equipment consists of one two-compartment 40 feet suburban car, with cross seats in one compartment, having Canada Switch & Spring Company's trucks and four Westinghouse 12 A motors. The car body was built by A. C. Lariviere, of Montreal. The road is operated by the Berlin & Waterloo Street Railway Company, which has in all, including the Bridgeport car, 14 cars and trailers, seven of them being complete mortor equipments. The company recently installed an 80 ampere Gould storage battery, which provides for power also for the new line.

LAMP HINTS.

The frosting of lamps much improves their diffusion of light, and their use should be much increased in view of the agreeable and effective light resulting. Contrary to the common impression, the loss of light through frosting is very small, the average total loss being only about three per cent.

For decorative illumination, low candle power lamps should be used, lamps of eight or ten candle power giving much more effective and artistic results than those of higher candle power.

Do not expect a lamp ordered for one voltage to give satisfaction on another voltage. If the voltage at different points on your system is widely varying, use lamps of different voltages to suit.

The approximate variation in candle power and life corresponding to various percentages of the normal voltage is shown by the following table:

Voltage	Candle Power	Life
per cent of normal	per cent. of normal	per cent. of normal
90 per cent.	53 per cent.	850 per cent.
95 "	73 "	300 "
97 5 "	86 "	175 "
100 "	100 "	100 "
102.5 "	115 "	70 "
105 "	132 "	55 "
110 "	172 "	14 "

The average life of 3½ watt lamps is one-half that of lamps having an efficiency of 4 watts per candle. The 3 watt lamp has about half the life of the 3½ watt.

For equal results in useful life low candle power lamps must have lower efficiencies than lamps of sixteen candle power.

Do not expect to measure the efficiency of a lamp accurately with a recording watt meter.—From Packard Electric Company's Lamp Catalogue.

SPARKS.

Mr. H. A. Connell, of Woodstock, N.B., has placed a turbine wheel of 150 h.p. in the Davis mill property, and another of 250 h.p. is to be installed. Mr. Connell will supply power to his foundry and run his electric lighting system. Mr. Connell, by the use of the water power of the Meduxnakeag, expects to effect a saving in fuel of over $3,000 per year.

Suit has been entered against the town of Orillia, Ont., by P. H. Patriache and the Electrical Maintenance & Construction Company, of Toronto, to recover the sum of $220,000 as damages claimed for the breaking of a contract for the building of a power plant, the company claiming that the town officials were negligent, and so contributed to the delays which finally caused the rupture. The defence enters a general denial to this charge, and says that the contractors brought the trouble upon themselves.

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THE REGISTRAR.

TRADE WITH ENGLAND

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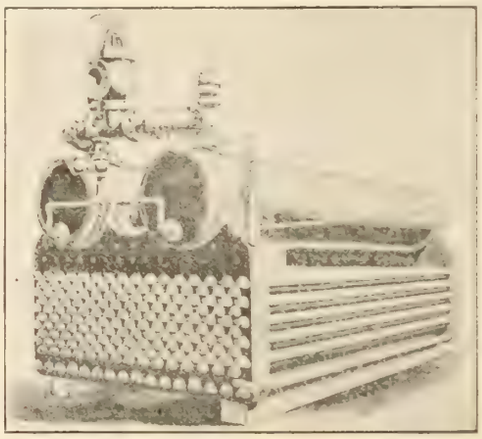
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JOHN J. MAIN, Manager.

Esplanade, Opp. Sherbourne St., Toronto

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for all pressures duties and fuel. From 75 to 600 h. p. each. N. B.—We do not make small boilers.

Reference: The Toronto Electric Light Co., Limited; The T. Eaton Co., Limited; The Massey-Harris Co., Limited, The Gutta Percha Rubber & Mfg. Co., Dominion Radiator Co., Central Prison, Foresters' Temple, Toronto City Hall where boilers may be seen working.

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THE PORTAGE LA PRAIRIE PLANT.

AURORA, ONT., Aug. 14th, 1902.

Editor ELECTRICAL NEWS :

Dear Sir,—The description in last issue of the ELECTRICAL NEWS of the Central Electric Company's lighting plant is somewhat incorrect. Having had charge of the plant for two years, from June, 1891, to June, 1893, I know pretty well as to the start of the business.

The first installation consisted of two old second hand boilers, 48 and 52"x14', and a 13x34 Wheelock engine, 10 ft. fly wheel, one 750 light National and one 650 light Thomson & Houston alternator ; two independent sets of primaries on the streets, and arranged on switchboard so as to be switched on to either machine or run separately. In the fall of 1892 a low pressure cylinder was put in, making the engine a cross compound condensing one, the same as in illustration, also a 54"x14' boiler, independent iron stacks to each boiler. A 25 light Ball arc machine was also added to the plant, with seven arc lights of 2,000 c.p. on the main street.

Yours truly,
W. H. BIRCHARD.

TESTS OF THE SLEEPER ENGINE.

We have received a copy of a report on tests of the sleeper engine made at McGill University, Montreal, by Homer M. Jaquays, Assistant Professor in Mechanical Engineering. The engine tested was a single cylinder, single-acting engine of about 12 brake horse power. The steam used was about 98 per cent. dry. The object of the trials was to determine the steam consumed by the engine per brake horse power per hour when working at various loads. The loads chosen were approximately one-third full load, two-thirds full load, and full load. Trials were made for a length of time sufficient to obtain results accurate enough for comparative purposes. From the results obtained it was inferred at what cut-off, pressure and speed the engine would work economically, and trials of longer duration were made under these conditions. In all cases the results obtained from the shorter trials agreed, within the limits of error, with those obtained from the longer trials. The steam consumed per brake horse power per hour is low for an engine of this small size. Professor Jaquays states that it is considerably lower than that of any other rotary engine tested, to th date,at in the McGill laboratory.

The results obtained from the trial are given as follows :

Trial No.	B.H.P.	Revs. per min.	Steam used per B.H.P. per hour	Steam pressure guage
1	5.63	650	56 5	44 1/3 full load.
2	10.2	707	40.4	53 2-3 full load.
3	13.1	726	36.4	84 full load.

The British thermal units for B.H.P. per hour were : Trial 1, 905 ; trial 2. 647 ; trial 3, 590. Variations in speed between 650 r.p.m. and 725 r.p.m. made very little difference in economy.

In trial No. 3, full load, 36.4 pounds steam per brake horse-power per hour were used. This is an exceptionally good result for a single acting single cylinder engine.

The sleeper engine is now manufactured by the Sleeper Engine Company, Limited, at 156 St. Antoine street, Montreal.

PERSONAL.

Mr. W. Cowan has resigned as manager of the Revelstoke Water, Light & Power Company, and has been succeeded by Mr. Robert Gordon.

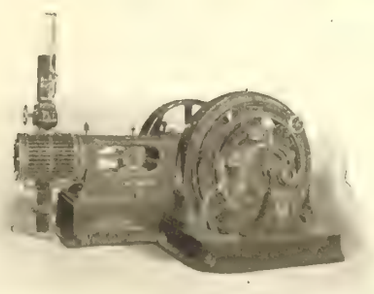
Mr. G. Grove has been appointed superintendent of the municipal electric light plant at Parry Sound, Ont., at a salary of $900 per annum.

Mr. Charles N. Peake, of the Toronto Technical School staff, spent his vacation in the draughting-room of the General Electric Company at Lynn, Mass.

The Bell Telephone Company are erecting an addition to their manufacturing plant in Montreal, to cost about $20,000.

The town council of Rat Portage, Ont., will submit a by-law to the ratepayers providing for the construction of an electric railway from Rat Portage through Norman to Keewatin.

THE PEER OF ALL HIGH SPEED ENGINES = THE McEWEN



For severe and rapid fluctuations of load no engine ever designed will give such service and regulation as the McEwen.

It instantly takes up any load no matter how severe and is equally as responsive to meet any diminution of load.

THIS GUARANTEE—the strongest ever given with any engine goes with every McEwen. No more positive proof could be given as to its regulation.

"The engine shall not run one revolution slower when fully loaded than when running empty and a reduction of boiler pressure from the greatest to that necessary to do the work will not reduce the speed of the engine one revolution. ANY ENGINE FAILING TO MEET THIS GUARANTEE BECOMES THE PROPERTY OF THE PURCHASER UPON PAYMENT OF ONE DOLLAR."

For electric lighting, electric railway, electric crane and mine haulage the McEwen cannot be surpassed. Let us send you the Catalogue.

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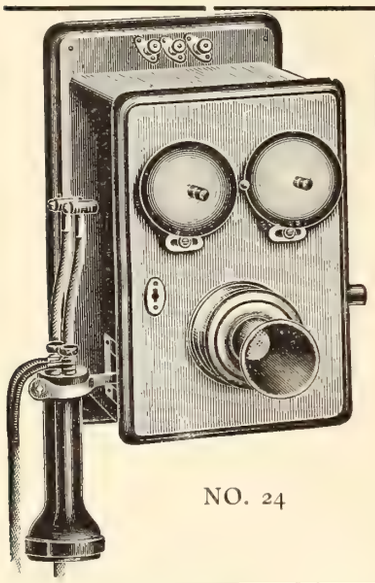
NOTES.

Hon. Thomas Greenway has under consideration a scheme to light all his farm buildings at Crystal City, Man., by electricity, and at the same time generate sufficient power to furnish light for the village. An engineer is now making an estimate of the cost.

The Toronto Electric Light Company have removed their general offices to their new building, 10 to 14 Adelaide street east. In their show-room they are displaying a line of the most artistic electric light fixtures, including a selection of L'Art Nonveau fixtures.

Sampling steam to obtain a fair average for quality determinations is sometimes attended with considerable unreliability, according to Professor John Goodman, of the Yorkshire College, Leeds. In a paper before the recent meeting of the British Association for the Advancement of Science, at Bradford, England, in which he described a new form of calorimeter he had designed for measuring the moisture in steam, he referred to a case where three sampling pipes were inserted in a steam pipe at different points, the boilers feeding the pipes, it should be added, priming very seriously. In one case the sample was taken by a vertical pipe at the low end of a nearly horizontal length of pipe near the engine steam chest. The moisture present was over 40 per cent. Another vertical sampling pipe was put in a horizontal length of steam pipe close to the boilers. The quantity of moisture was found to be 19 per cent. ; a horizontal sampling pipe close to the last gave 2 per cent.

Congratulations are being extended to Mr. J. Alex. Culverwell, of Peterborough, who on August 14th took as his life partner Miss Jessie Houghton, daughter of Mr. J. D. Hill, of New York, and sister of Mrs. (Captain) H. H. King, of Penryn Park, Port Hope. The ceremony was performed in St. John's church, Port Hope, by Rev. E. Daniel, assisted by Rev. Principal H. Symonds, Trinity College School.

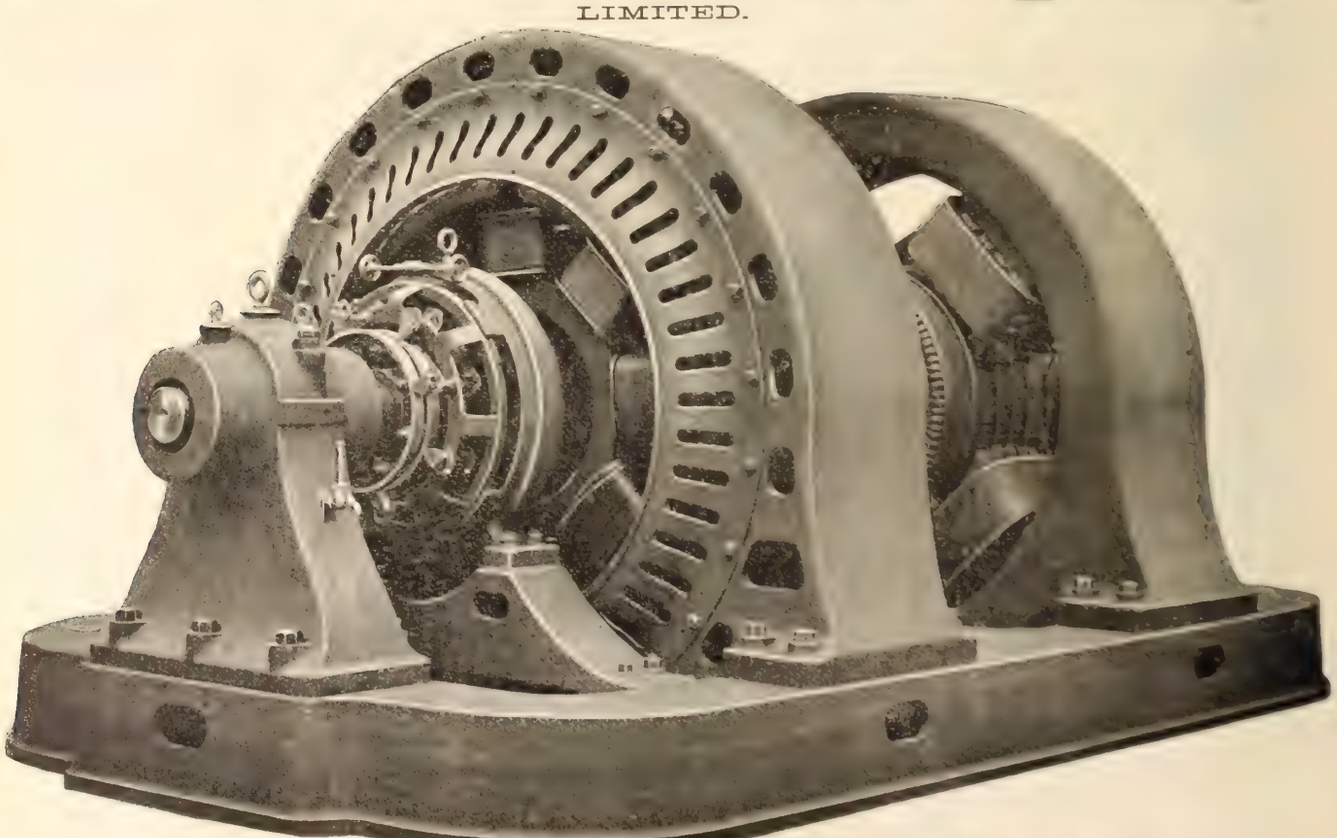


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TRADE NOTES.

Westinghouse, Church, Kerr & Company announce the removal of their New York office from the Havemeyer Building, 26 Cortlandt street, to the Maritime Building, Nos. 8 to 10 Bridge street, opposite new Custom House and near Bowling Green.

The R. E. T. Pringle Company, Limited, Montreal, are putting on the market a device for controlling the current used by flat rate customers which promises to have a large sale. It was exhibited during the convention of the Canadian Electrical Association at Quebec, where it was very favorably commented upon by those who saw it.

The Canadian General Electric Company are sending to their customers a neat leather binder, in order to provide a handy means of keeping in easy reach the descriptive literature which they send out from time to time. By a unique arrangement printed matter may be easily and quickly inserted in the binder, eventually forming a complete and up-to-date catalogue of their products. One of their most recent publications is a catalogue and price list of sockets and receptacles, which contains much information and which should be in the hands of all persons interested. This catalogue is No. 314.

The Canada Atlantic Railway have completed a private metallic circuit telephone line between Ottawa and Depot Harbor. In its construction, covering a distance of 262 miles and return, about 524 miles of copper wire have been strung. Part of the contract was executed by Mr. Robert Anderson, electrician, of Ottawa, while the remainder was carried out by the company under the direction of Mr. LaBrie.

Messrs. Longmans, Green & Company, 39 Paternoster Row, London, E.C., have issued a Text-Book of Electrochemistry. The book is by Svante Arrhenius, professor at the University of Stockholm, and has been translated into English by John McCrae. The basis of the work is a series of lectures delivered by the author at the University in the autumn of 1897. The work contains seventeen chapters, treating of such subjects as electrolytes, calculation of electro-motive forces, potential differences between two bodies, development of heat by the electric current, etc. The retail prices is 9s 6d net.

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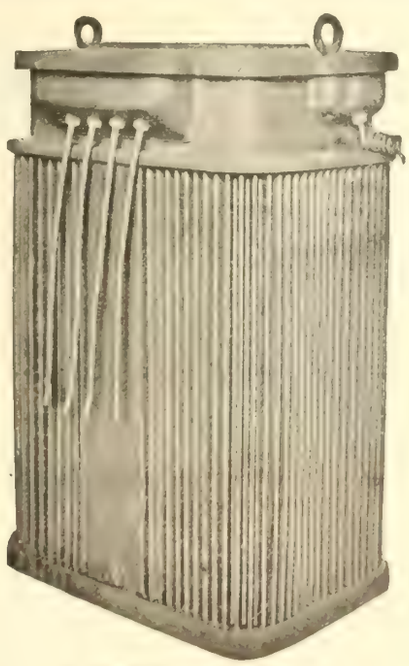
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SPARKS.

Carse & Daly, dealers in electrical supplies, Victoria, B.C., have sold out to the Nesbitt Electric Company.

The Gee Electrical Engineering Company, of Toronto, have secured the contract for installing storage batteries, dynamos and motors at the Burlington Bridge, Hamilton, for the Dominion Government.

The Shawinigan Water & Power Company have submitted to the Dominion Government a proposition to light the channel of the St. Lawrence river from Montreal to Quebec. The details of the plan, which is one of the most comprehensive of the kind ever proposed, have been laid before the Government.

Judges Morgan and Mahaffy, and Mr. J. F. H. Wyse, of Brantford, have taken evidence in the arbitration case for the purchase by the corporation of Gravenhurst, Ont., of the electric plant owned by the Gravenhurst Electric Light Company. The corporation offers $13,000, while $18,500 is asked.

The Cape Breton Electric Company hopes in the near future to have in operation the longest electric tramway system in the Maritime Provinces and the most modern power house east of Montreal. The cars for the Sydney service have arrived and those for the suburban line are expected shortly.

Messrs T. Pringle & Sons, of Montreal, have reported to the Water and Light Commissioners of Fort William, Ont., that it will cost $207,000 to develop 2,000 horse power at the Ecarte Rapids. The question is now under consideration. It is probable that meters will be installed on the Fort William lighting system.

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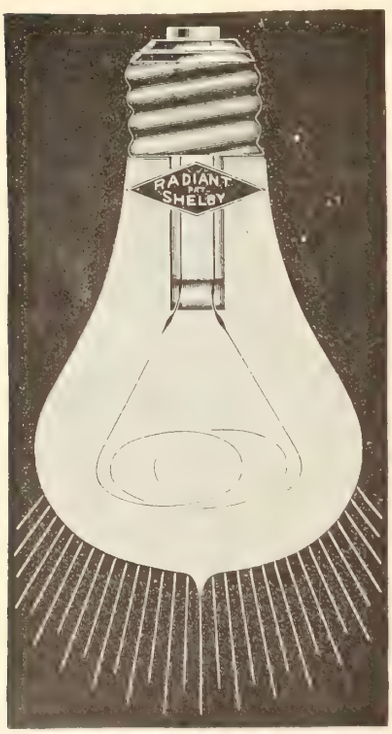
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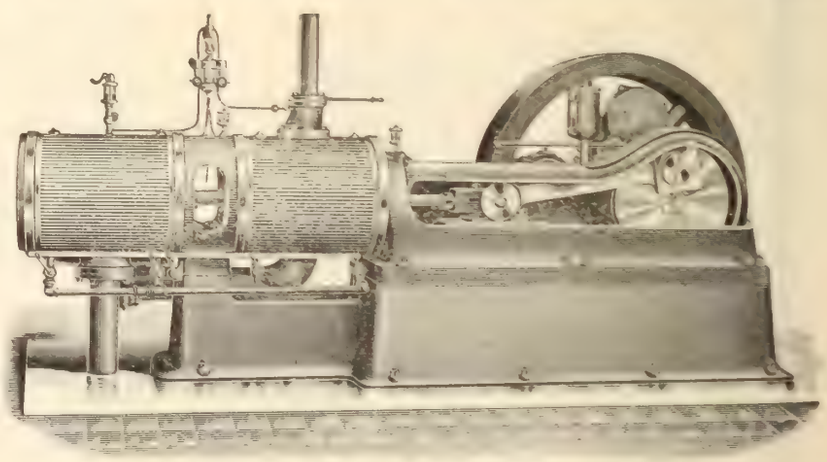
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SPARKS.

By a fire which started in the mills of A. McKillop & Sons at West Lorne, Ont., the plant of the Electric Light Company was damaged to the extent of $2,000.

The Canadian General Electric Company secured the contract for the electric light plant for Newcastle, N.B., at the price of $8,750. E. Leonard & Sons, of London, will supply a 125 h. p. automatic cut-off engine and fixtures, at $1,730.

The Great Fall Power Company have requested the city council of Winnipeg, Man., not to give exclusive privileges over the Louise bridge to any other company, as they contemplate building an electric railway from Winnipeg river to the city.

Mr. E. S. Harrison, of Winnipeg, has made a proposition to establish electric light and telephone systems at Carberry, Man. He offers to light the streets with three arc lights and 52 c. p. incandescent lights for $800 per year, and to provide telephones at $12.50 per year for residences and $25 for business establishments.

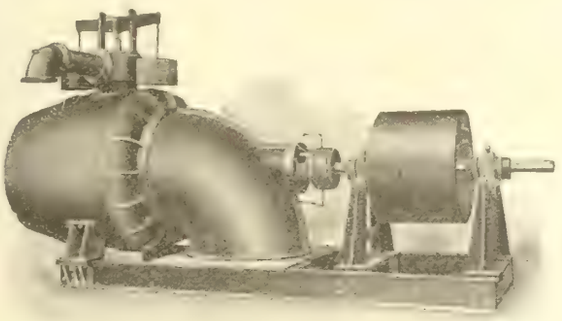
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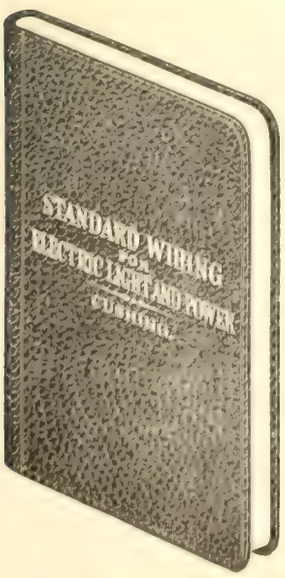
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SPARKS.

The Suburban Electric Railway Company are negotiating for the extension of their line to Islington.

Woodstock, Ont., has sanctioned a by-law to raise $10,000 for improvement and extension of electric light plant.

A thirty-five light arc machine is to be added to the electric plant of the corporation of New Westminster, B.C.

A new hotel is to be built at Dorset, Ont., in which an eleciric light plant will be installed. The architect is Mr. R. M. Ogilvie, of Toronto.

It is the intention of Mr. Fraser, manager of the Petrolia Electric Light Company, to make improvements to the plant, at an approximate cost of $7,000.

It is reported that the Westinghouse Air Brake Company have definitely decided to establish a factory in Hamilton for the manufacture of electrical apparatus.

The ratepayers of Longue Pointe have voted in favor of granting a franchise to the Montreal Street Railway Company to extend their Notre Dame street line to the parish.

The corporation of Lucknow, Ont., has taken prices on the installation of an electric light plant. Particulars may be obtained from Mr. Hugh Morrison, village clerk.

The ratepayers of Sandwich West recently voted down the by-law to grant a bonus of $5,000 for the extension of the Sandwich, Windsor and Amherstburg Electric Railway to Amherstburg.

It is understood that the St. Johns Electric Light Company have signed an agreement to purchase power from the Montreal Light, Heat & Power Company, and that the work of building the line is now under way.

At the Deauville motor car races on August 24th, the race for the kilometre championship of the world was won by Gabriel on a motor car. He made the distance in 26 2-5 seconds, which is at the rate of 84 miles an hour.

The Bell Telephone Company have found it necessary to increase the accommodation at their Toronto Exchange, for which puspose a new building will be erected adjoining their present exchange on Temperance street.

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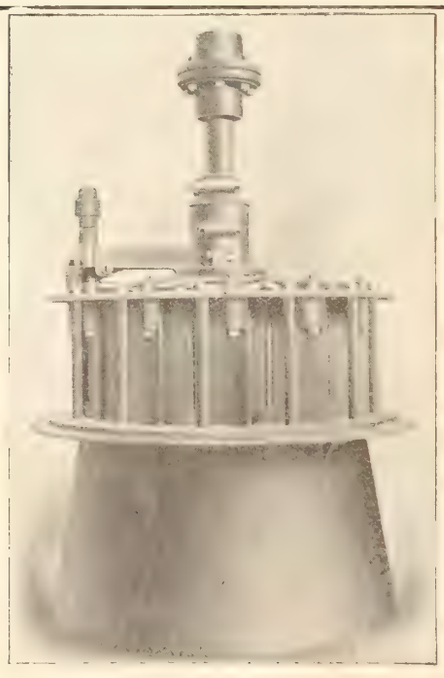
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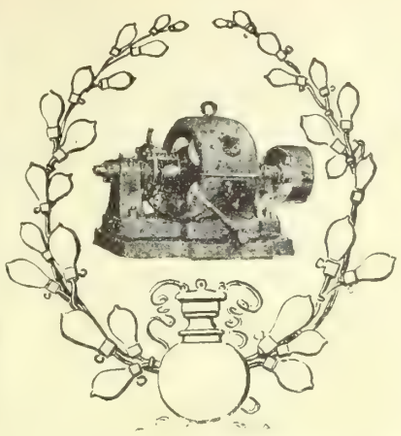
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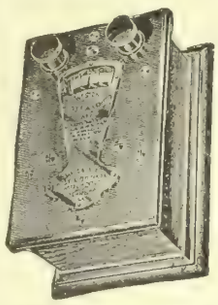
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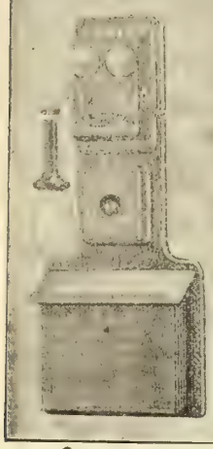
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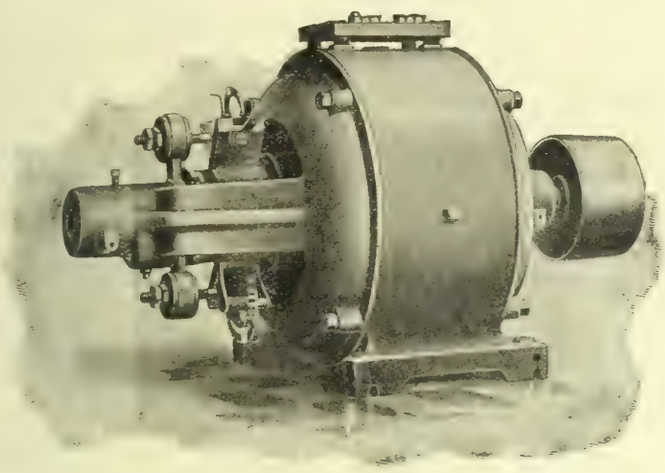
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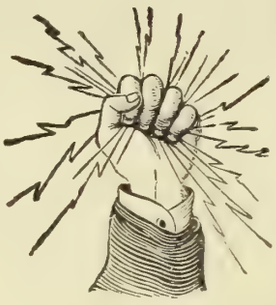
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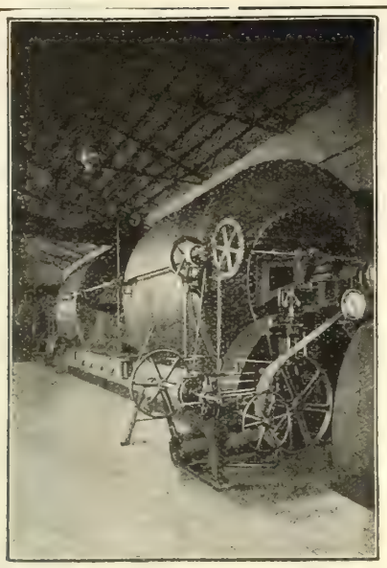
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Head 40 feet. — 2,800 Horse Power. — 300,000 Pounds.
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The Goldie & McCulloch Co., Limited,

GALT, ONTARIO, CANADA

Recently received the following unsolicited testimonial, which speaks for itself :

TORONTO, Aug. 6th, 1902.

THE GOLDIE & MCCULLOCH CO , GALT, ONT.

DEAR SIRS :—In our recent fire which, as you know, was a total wreck, and of which we are sending you a photo by this mail, we had two Goldie & McCulloch safes in which we kept all our books. They have come through the fire in remarkable shape and we feel that our praise for your safes cannot be great enough. This fire was an extremely hot one, the locality in which these safes were being surrounded by hay and grain as well as large quantities of packages, barrels and boxes. We might say that everything was burned to a crisp, hea y iron being twisted and melted into frightful shape. We had almost given up all hope of being able to get the books and documents from the safes in such a manner as to make them of any use to us, which we can assure you would have been a very serious matter. We were agreeably surprised, however, on reaching them. While we found the safes somewhat warped and bent on the outside, yet all our books and documents came out in such a manner that we can get everything from them all right. This without a doubt was an extremely hot fire, and the way in which they came through it leaves no room for question as to the manner in which they are made and the stuff they are made of.

Again congratulating you on the safes you turn out and trusting we will have the pleasure of purchasing from you when we again rebuild, as we know of none better, we are,

Yours truly,
P. MCINTOSH & SON.

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We Make

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SPARKS.

Extensive improvements are being made to the electric plant at North Bay, Ont.

The Armstrong Light & Power Company has been formed at Armstrong, B. C., to supply light and power.

The annual meeting of the Quebec Railway, Light & Power Company has been called for October 9th.

The Phoenix Electric Lighting Company, Limited, of Phoenix, B. C., has been incorporated, with a capital of $50,000.

Mr. Brethour contemplates building an electric railroad between St. Marys and Kirkton, so as to handle his implement trade.

The machinery for the Ross Rifle factory now in process of construction at Quebec is to be operated in gangs by electric motors.

The Ontario Government is installing electric apparatus at the Orillia Asylum, where 80 horse power will be used for motors and light.

A by-law to purchase the water and electric light plants at Revelstoke, B. C., was carried by the ratepayers, the vote being 85 for and 9 against.

There has been installed at the Ontario Agricultural College, Guelph, Ont., an electric plant, consisting of 50 k. w. dynamos and two 12x12 McEwen high speed engines, the latter supplied by the Waterous Engine Works Company, of Brantford.

Incorporation has been granted to the Mexican Light and Power Company, to carry on business in Canada as an electric light, heat and power company. The incorporators include Messrs. D.B. Pearson, of Halifax, R. E. Harris, C. H. Cahan, H. A. Lovett and Fred. Pearson.

It is the intention to operate the machinery in the new Canadian Pacific Railway workshops at Montreal by means of direct connected motors. Direct current motors will be employed for this purpose, owing to the varying speed of the machines. A separate lighting plant will also be installed, for which alternating current will be used.

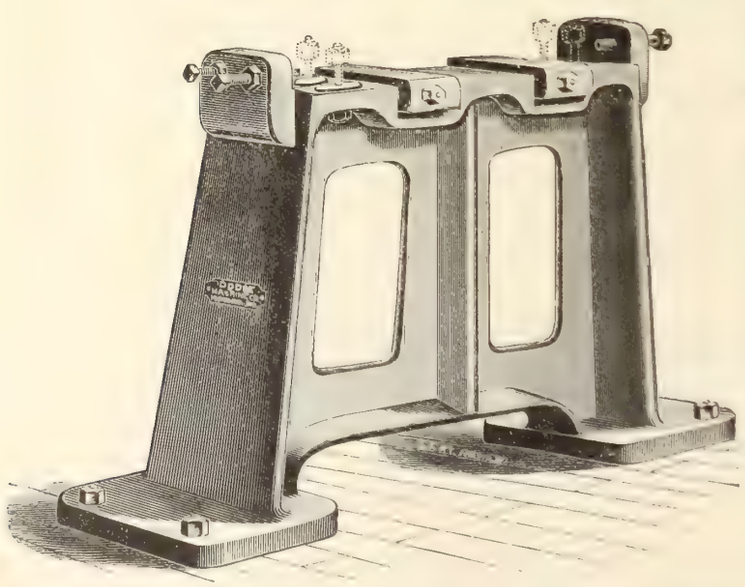
Mr. R. A. Ross, E. E., of Montreal, has reported on the valuation of the plants of the Owen Sond Electric & Illuminating Company and the Owen Sound Gas, Light & Fuel Company. Based on his report the council have offered $29,507.64 for the electric light plant and $32,817 for the gas plant. These figures are not likely to be accepted by the companies, and it is probable that the matter will be submitted to arbitration under the terms of the Conmee Act.

MOONLIGHT SCHEDULE FOR NOVEMBER.

Day of Month.	Light.		Extinguish.		No. of Hours.
		H.M.		H.M.	H.M.
1....	P.M.	5.20	P.M.	6.00	13.20
2....	"	5.20	"	6.00	13.20
3....	"	5.20	"	6.00	13.20
4....	"	5.20	"	6.00	13.20
5....	"	5.20	"	6.00	13.20
6....	"	8.30	"	6.00	9.30
7....	"	9.30	"	6.00	8.30
8....	"	10.30	"	6.00	7.30
9....	"	11.30	"	6.00	6.30
11....	"	0.30	"	6.00	5.30
12....	"	1.30	"	6.00	4.30
13....	"	2.40	"	6.00	3.20
14....	No Light.		No Light.		
15....	"		"		
16....	"		"		
17 ...	A.M.	5.00	A.M.	8.30	3.30
18....	"	5.00	"	9.30	4.30
19....	"	5.00	"	10.30	5.30
20....	"	5.00	"	11.45	6.45
21....	"	5.00	"	0.45	7.45
22....	"	5.00	"	1.50	8.50
23....	"	5.00	"	3.00	10.00
24....	"	5.00	"	4.00	11.00
25....	"	5.00	"	5.00	12.00
26....	"	5.00	"	6.00	13.00
27....	"	5.00	"	6.30	13.30
28....	"	5.00	"	6.30	13.30
29....	"	5.00	"	6.30	13.30
30....	"	5.00	"	6.30	13.30
				Total.....	248.50

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For Electric Light and Power Plants.



Floor Stands,
Self-Oiling Pillow Blocks,
Steel Shafts,
Friction Clutch Pulleys,
Clutch Couplings,
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Belt Tighteners, Etc.

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TORONTO, ONT.

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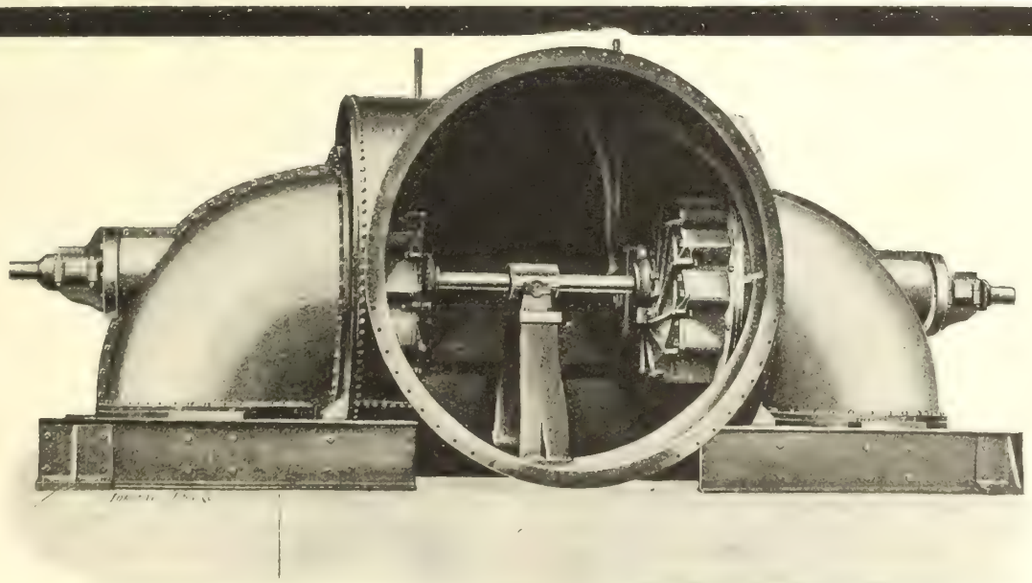
Constructed along new lines, much more compact than the old styles, with increased space for ventilation, a low difference in potential between layers, an almost indestructible insulation between the coils and iron and between the individual coils, types R and S give not only the maximum of safety but the **Highest** efficiency and **Closest** regulation.

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Descriptive pamphlet on request.

TYPE R TRANSFORMERS TYPE S

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LAMPS, TRANSFORMERS & METERS.
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Rossland and Greenwood, B. C.

The JENCKES MACHINE COMPANY.

Main Office and Works:
32 Lansdowne St.
SHERBROOKE, QUE.
CANADA.

SPARKS.

Mr. R. A. Estey, of Fredericton, N.B., is installing an electric light plant in his saw mill.

The Bell Telephone Company intend laying more underground conduits in the city of Ottawa.

A company is being formed at Levis, Que., to engage in the manufacture of street railway cars.

The Windsor, Sandwich and Amherstburg Railway Company have decided to extend their line from Ojibwa to Amherstburg.

The Montreal branch of the Canadian General Electric Company has been removed to new and more commodious quarters at 81 St. Peter street, corner St. Sacrament.

Tenders for installing an electric light plant in the City Hall, Toronto, will be received by the Mayor up to October 14th. The generator will be a 25 kilowatt machine.

The contract for water wheels for the power development of the Vancouver Power Company at Coquitlam Lake, B.C., is reported to have been secured by the Pelton Water Wheel Company.

The Dominion Coal Company are about to install a telephone system at the mines at Sydney, N. S. There will be about 75 instruments, one at the bottom of each pit, one at every second landing, and one in each manager's office.

We have received from the Canadian General Electric Company, of Toronto, a sample of their new style of socket bushing. This bushing is made to suit the requirements of the Underwriters' rules and is kept in stock in all of the warehouses of the company.

The appeal of the Kingston Light, Heat & Power Company, against the decision of the arbitrators respecting the valuation of their electric plant, was heard at Osgoode Hall, Toronto, a few days ago. It is not expected that a decision will be given before a month.

At the annul meeting of the Metropolitan Power Company, held at Ottawa last week, officers were elected as follows: President, Thomas Lindsay; first vice-president, Charles Jenkins, Pretolia; second vice-president, William Arnold; secretary, George A. Wanless.

The Goderich Organ Company have purchased from the United Electric Company, of Toronto, the 200-ligh dynamo shown at the Toronto Exhibition. It is intended to replace the 100-light machine now used in lighting the organ factory.

A company has recently been formed to build mono-rail electric lines in the Kootenays in British Columbia. It is composed of Minneapolis capitalists, amongst whom are Messrs. Judgson & Loyhed. Water rights on Kaslo River have already been secured, and Kaslo will be the headquarters and base of operations.

The electric street railway of St. Thomas, Ont., has passed into the hands of the city, the company having failed to meet their obligations. It is not known what steps will be taken to continue the operation of the road, as the expenditure of a considerable amount of money is required for rolling stock, new engines, etc.

It is the intention of the Collingwood Shipbuilding Company to operate their works as far as possible by electricity, for which purpose an electric plant will be installed. The boiler house will be of brick and iron, 120x80 feet, and the power house will be 30x80 feet. These buildings are just being commenced. Three 30-ton electric cranes will be installed.

The contract for electrical work in connection with the new Vancouver Hotel at Vancouver has been secured by the A. F. Barber Company, of that city. Contracts have also been secured by this firm for electric wiring and installation in connection with the C. P. R. hotel at Banff, new Government steamer Kestrel, and the new Turnstall block on Granville street, Vancouver.

The Fairbanks Company, Craig Street, Montreal, have concluded arrangements with the Dodge Manufacturing Company, of Toronto, for their general agency for Montreal and vicinity. An entire new stock of Dodge standard pulleys has been put in, as well as various stocks of Dodge transmission goods, including ball and socket hangers, flange and grim death couplings, safety collars, improved self-oiling bearings, all types, etc. All of these standard lines will be carried in stock at the Fairbanks Company's warerooms, for immediate shipment at factory prices.

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As a general rule you do not know
that you require a transformer
until your customer signs his
light contract.
The customer expects his light
right away,
if he is like ordinary people.
What does he know or care about
ordering—and waiting for—
a transformer?
Your success depends largely upon
prompt and reliable service.
Pittsburgh transformers—in stock
ready for shipment
will help you get business and
keep it.

Pittsburgh Transformer Company

Pittsburgh, Pa., U. S. A.

OF SPECIAL INTEREST TO CENTRAL STATION MANAGERS

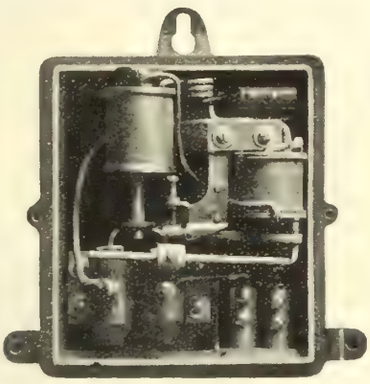
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For Controlling Current Used by Flat Rate Customers.

Manufactured in Canada by

The ALPHA ELECTRIC MFG. CO., Limited

MONTREAL



Under Patent No. 66,873.

A customer can have 20 lights distributed through his residence, but with this device their use can be regulated to any number for which he desires to pay.

He cannot use more current than he pays for.

A boon to Central Station Managers. No disputes with customers. Saves expense of reading and testing meters.

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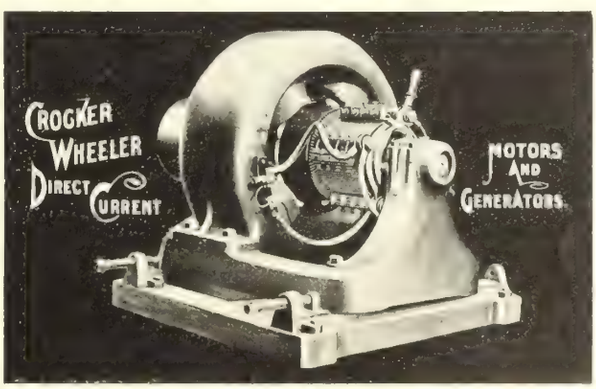
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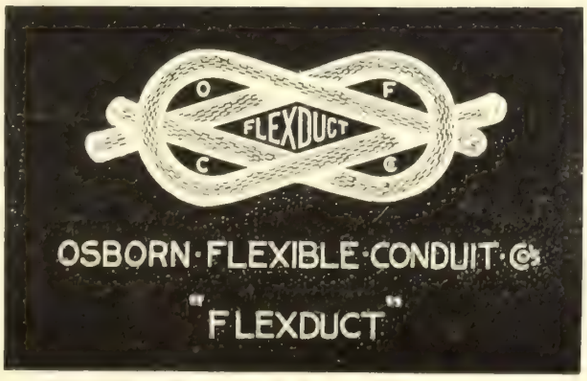
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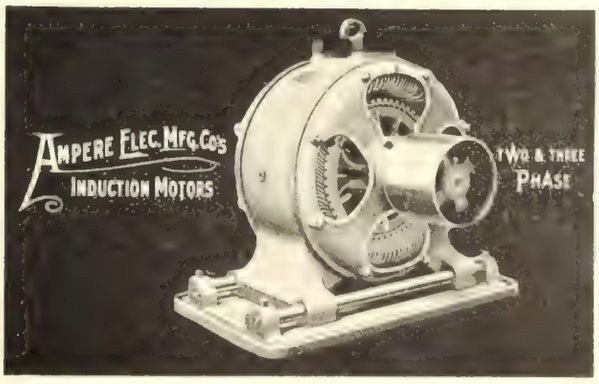
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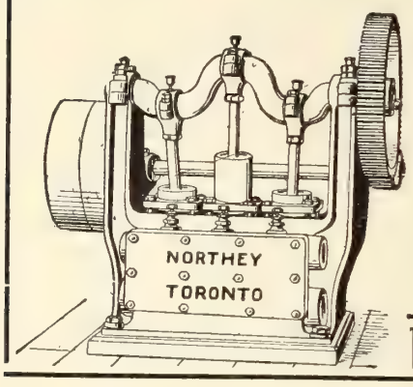
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INTERIOR CONDUIT

Iron Armoured Flexible Metallic ;
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THE NORTHEY TRIPLEX POWER PUMP



This pump excels in high class materials and workmanship. A practically constant delivery is assured by the three cranks being placed 120 degrees apart. The pump can be operated conveniently by water power—by belt from engine or by electricity.

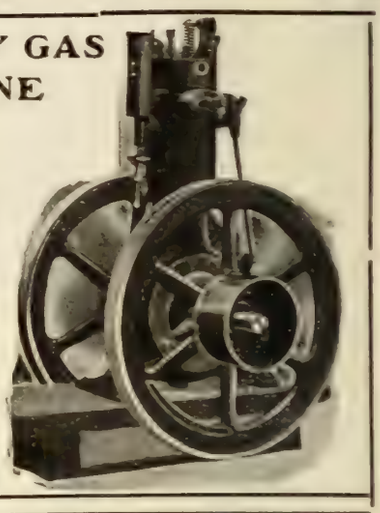
We manufacture pumps of every description—for all purposes. Our pumps are standard in Canada for excellent service.

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The NORTHEY GAS AND GASOLINE ENGINE

The Northey Gasoline Engine offers the best proposition in the market for cheap, easily handled power. The Engine runs with practically no attention—any boy can manage it—running expenses very light. Ready for work on the minute. Suitable for running independent electric light plants—pumping and elevator plants, etc. This cut illustrates the ½ H. P. size—the only vertical style built; all other sizes are horizontal.

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TH NORTHEY CO., LIMITED, 970 King Street ubway TORONTO.

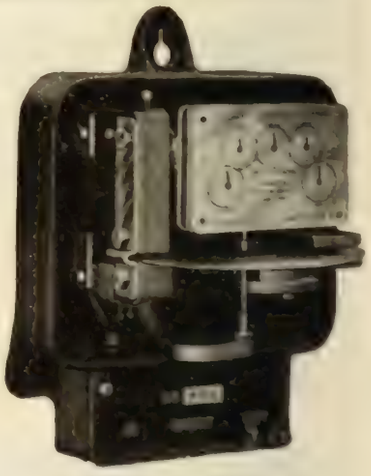
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FOR ALTERNATING CURRENTS



IN SHORT

The New Meter is of the sealed type.
Is correct on all loads from two per cent. of its capacity to fifty per cent. overload.
Internal losses are practically nothing.
Accuracy maintained.
Simplicity in design.
Firmly constructed.
Dust, insect, moisture and water proof.
Extremely light weight (10 lbs.)
Pleasing in appearance.
Reads directly in watt hours.
Easily installed.
No complicated parts.
No friction.

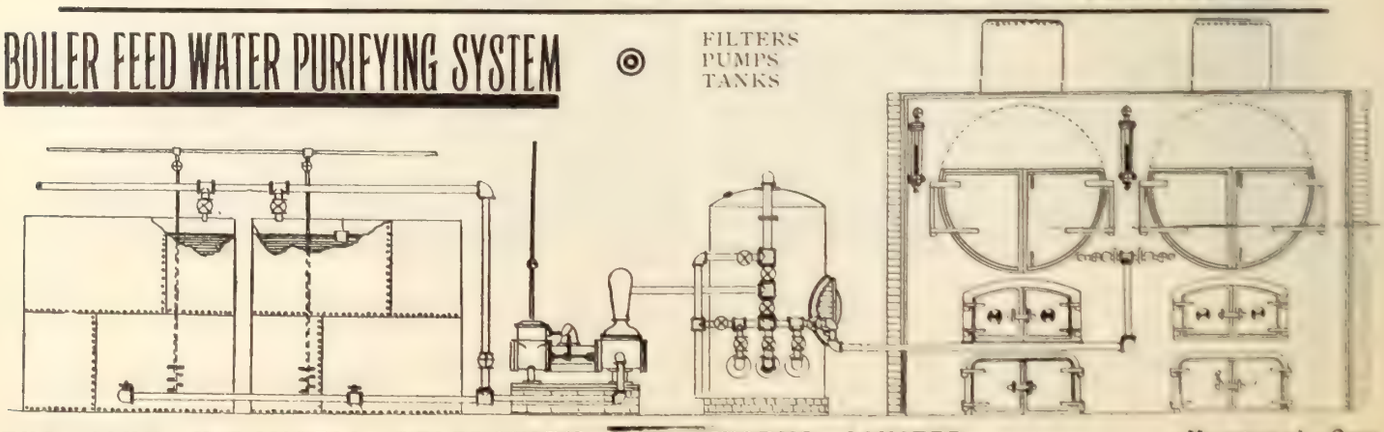


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708 and 710 Craig Street
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BOILER FEED WATER PURIFYING SYSTEM

FILTERS
PUMPS
TANKS



THE JOHN McDOUGALL CALEDONIAN IRON WORKS, LIMITED, - - Montreal, Que.

CANADIAN
ELECTRICAL NEWS
AND
ENGINEERING JOURNAL

VOL. XII. OCTOBER, 1902 No. 10.

IMPROVEMENTS AT FREDERICTON, N. B.

Fredericton, the capital city of New Brunswick, is one of the most attractive towns in Canada. It has many handsome buildings and the streets are lined with magnificent trees. In front flows the broad river spanned by two bridges nearly a mile in length. A great deal of public spirit is manifested in many directions. Among the more recent improvements is the substitution by the electric light company of modern enclosed arc lamps for the old-style open arcs on the streets and in the stores and other business places. The improvement is a very noticeable one and has given the greatest satisfaction to the citizens, besides relieving the company of complaints of lights out, which with the open arcs were quite frequent and entailed not only inconvenience to customers, but loss to the company, who by the terms of their agreement were charged double price for all lamps which failed to operate continuously. The company are understood to be considering further improvements which will enable them to give an all night service. At present the plant is operated on the moonlight schedule.



PARLIAMENT BUILDINGS, FREDERICTON, N. B.

Sixty-seven arc lights are supplied under contract with the city to light the streets, and 35 for commercial lighting. In addition there are about 350 incandescent lights. Current for the arc lighting is generated by a Reliance and a new Brush dynamo, and for incandescent lighting by two Edison D. C. machines. The Brush machine is operated by a 50 h. p. Armington & Sims high speed engine, and the other machines by a 50 h. p. Wheelock made by the Goldie & McCulloch Co., of Galt, Ont. A 100 h. p. Armington & Sims engine is kept in reserve and will no doubt shortly come into use when the service is extended. A new brick chimney stack is in process of construction, which gives improved draft.

The company control the supply of both electric light and gas, and represent an amalgamation of two companies which previous to 1900 operated individually. The electric light plant is in charge of Mr. W. H. McGinn, who has had the management ever since the plant was first installed, thirteen years ago, with the exception of a few months. The appearance of the station is a sufficient proof of his intelligent care. There seems little doubt that in a city of 7,000 inhabitants, the field for incandescent lighting can be greatly extended, and that, too, without greatly interfering with the gas lighting. There is also no doubt a field for the supply of electric power, which as yet has received no attention whatever.

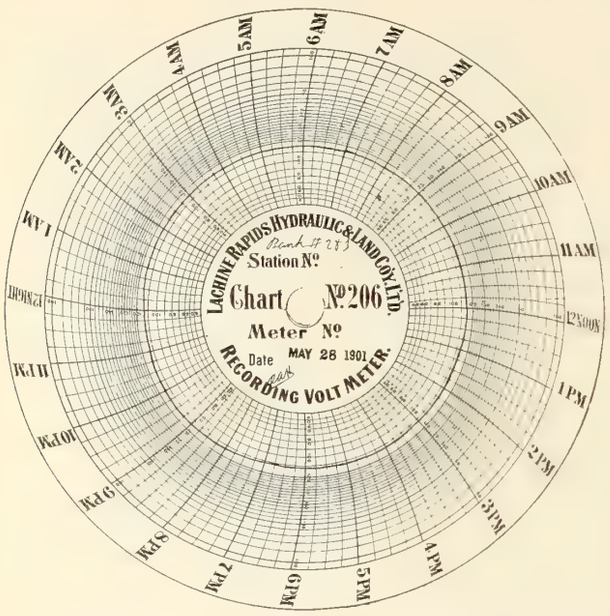
STEAM VS. WATER POWER.

SALT LAKE CITY, UTAH, Sept. 11th, 1902.

Editor CANADIAN ELECTRICAL NEWS :

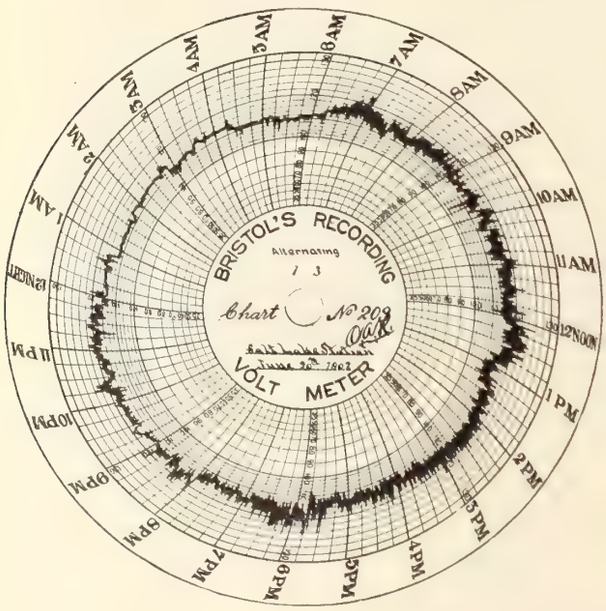
DEAR SIR:—Referring to your editorial, "Steam vs. Water Power," in the August issue, I send you a blue print of a voltage chart taken off the main distibution busbars of a Canadian plant, with which, perhaps, you are very familiar.

From this station we supplied both our motor and lighting load, and the regulation shown by this chart was maintained month after month, showing that on a low head plant (17 feet) with a proper governor installation it is possible to obtain a thoroughly satisfactory regulation. This was without any steam or storage



battery auxiliary. The maximum load reached 6,000 h.p., and of this total about 50 per cent. consisted of induction and synchronous motors and two 450 k.w. rotaries on direct current service. On the chart herewith it is not possible to detect the starting at about 6 p.m. of two 400 h.p. 4,000 volts synchronous motors which were used to drive arc lighting machinery.

On a high head plant the problem of regulation is a more difficult one to solve, and I send you herewith a chart off a substation in which we step down from three water power stations, one with 450 feet head and the other two about 360 feet each. From this we handle



motor and lighting load, but the regulation is bad and very detrimental to incandescent lamps. It should be added that off this same system are operated rotaries supplying railway load. It might help the regulation to install a storage battery, but just as you point out in your editorial, it is now most advisable and the cheapest to install large steam direct connected units to give proper regulation as well as additional and more reliable power.

We have three water power plants and three transmission systems, 37 miles, 16 miles and 14 miles respectively, all working in multiple, and, outside of lightning and the "malicious boy" with the "baling wire", we have very few interruptions.

It thus comes down to the point of giving our now large number of power users a perfect and uninterrupted service. Therefore, at the present time a steam auxiliary must be put in, and, later on, additional water power developed.

Yours truly,

O. A. HONNOLD,

Formerly with the Lachine Rapids Hydraulic and Land Co., Montreal, Canada.

ELECTRICAL APPLIANCES IN THE DOMINION IRON AND STEEL WORKS.

The flexibility and adaptability of electricity and electrical apparatus is such that it has come into use for an almost infinite variety of purposes. It is therefore quite in order to learn that it is playing a most useful and important part in connection with the extensive works of the Dominion Iron and Steel Company at Sydney, Nova Scotia. By courtesy of the company, a representative of the ELECTRICAL NEWS was given the privilege of inspecting the works, in company with Mr. Boyd, chief electrician and assistant mechanical engineer, to whose kindness our readers are indebted for the following particulars concerning the electrical features of this great iron-making plant, which is destined to assume still larger dimensions, and is already giving a great stimulus to business in the Maritime Provinces :—

In connection with the coke ovens there are four elevators. Two have each three D. C. 220 volt multipolar series wound C. G. E. motors. One of 40 h. p. is used for conveying the crushed coke to the top of the elevator; another of 15 h. p. drives a belt conveyor which carries the coal from the top of No. 1 to No. 2 elevator. A 75 horse power motor is used to operate the coal crusher.

THE COAL WASHING PLANT.

In connection with this part of the plant there are employed nine direct current 220 volt shunt-wound C. G. E. motors—two of 75 h. p. each are used for crushing the lump coal, and conveying it to the shaker screens; two of 30 h.p. are employed in pumping water for washing the coal; two of 30 h.p. each for operating the shaker screens; one of 30 h.p. for running the jigs and conveying the dirt out to the dump; three of 15 h.p. each in conveying the washed coal to the top of a series of elevators at the coal washing plant.

The coke ovens have four pushers, on each of which are two motors—one 45 D. C. 220 volt multipolar shunt-wound Westinghouse for pushing the coke out of the ovens and another for traversing the pusher. There are also two charging cars at the ovens. Each of these cars has four Westinghouse motors—one of 40 h.p. D.C. 220 volt shunt-wound for charging the ovens and traversing the car, one of 5 h.p. for stamping, and two of 5 h.p. each for running the belt conveyor.

THE FURNACES.

There are five furnaces. Each has a scrap conveyor controlled by a 30 h.p. 220 volt, D. C. shunt-wound Westinghouse motor. There are also five scale cars, one being used for each furnace. Each car is operated by a 30 h.p. 220 volt series motor. The cars are used for handling ore, coke and dolomite, and for dumping same into the skip hoist buckets, which are then conveyed by hoists to the top of the furnaces and there dumped. There are three ore bridges to convey the

different ores to the pockets. The buckets on each bridge are operated by two 80 h.p., 220 volt direct current compound motors. When these motors are causing the buckets to scoop there is quite an intermittent load, sometimes requiring as high as 800 amperes.

At the crusher building connected with the open hearth building, there is a 100 h. p. D. C., compound-wound shunt motor for running a series of crushers, and in connection with the pig machine there are also three motors--one of 50 h.p., 220 volt multipolar, D.C. series wound, for hoisting and pumping the iron into pans that form the pigs ; one of 25 h.p. for removing the stirrups from the ladles; and one of 50 h.p. for running the series of pans and dumping the pigs on cars.

THE OPEN HEARTH BUILDING.

This building is equipped with two 75 ton electric cranes. Each has one main 60 h. p. bipolar 220 volt D. C. Westinghouse motor ; one 30 h. p. Westinghouse four-pole motor for traversing, together with an auxiliary hoist controlled by a 45 h. p. four-pole D. C., 220 volt series wound motor and a 5 h. p. ditto for traversing. There is also one 45 h. p. 220 volt D. C. multipolar series wound motor used for traversing the bridge. The main hoist is used for lifting 100 tons of steel in vessels to be poured into moulds, the vessels being emptied by tap holes in the bottom. The auxiliary hoist is employed for dumping cauldrons of metal into the furnaces while the ladles are suspended from the main hoist stirrups. This metal is afterwards mixed with ingredients to form steel. Each ladle weighs about 15 tons and holds 80 tons of metal.

A Wellman & Seaver charging car is employed for charging the furnaces with scrap. On this car there are three D. C. 220 volt series Westinghouse motors —one of 5 h. p. for turning the ram which empties the car of scrap into the furnace ; one of 30 h. p. for pushing the ram into the furnace; and one of 30 h. p. for travelling. The controllers on the car are of the Dinky type manufactured in Cleveland. They are subjected to very hard usage due to the rapid changes in direction.

Each furnace has a ventilating fan driven by a 5 h. p. 220 volt multipolar D. C., C. G. E. shunt motor.

Difficulty is found in securing the right kind of men to operate the charging cars. The position is one which requires remarkably quick action.

The stripping building, which contains the machinery for lifting the moulds off the ingots, is operated hydraulically.

THE BLOOMING MILL.

In this mill there is a scrap conveyor for carrying the scrap ends of billets from the shear table to flat cars. This conveyor is operated by a 30 h.p. series motor. The mill is also equipped with two 20 ton Morgan cranes used for placing the ingots in the soaking pits, and also for putting them on an ingot buggy run by a 30 h. p. motor which places them on the conveyor, to be rolled into billets. These ingots when placed on the conveyor are about 6 feet in length and are rolled out to a length of 136 feet. On each of the cranes there are four motors—one of 50 h. p. to raise and lower; another of 5 h. p. to open and close the tongs which hold the two ton ingot; one of 5 h. p. to run the trolley from side to side; and one of 30 h. p. to operate it to and fro. These are series motors of the Westinghouse type, 220 volt D. C. The main engine which operates the rolls of the blooming mill is a 1,250 h. p. reversible McIntosh, having cylinders 52 inches in diameter and pistons of 6 inch stroke.

MACHINE AND REPAIR SHOPS.

In connection with the works the company have a splendidly equipped and arranged machine shop. Such of the machines as must be operated to a large extent independently are run by individual motors, while those which operate continuously are driven by belts from a shaft operated by a 90 horse power motor. The shop is equipped with a 20-ton electric travelling crane, by means of which all the handling of heavy machinery is done. In the foundry adjoining the machine shop there are also two 15 ton cranes connecting with the machine shop. A 30 h.p. direct current motor is used to operate the fan for the cupola and to work an air compressor, which in turn operates drills in the billet yard. Air at 80 pounds pressure is used for various purposes throughout the plant.

In connection with the machine shop there is also a well equipped electrical repair shop in which is done all winding of armatures and fields and assembling of motors from core to body. All repairs on controllers, arc lamps and commutators are done here, as well as the making of all spare bearings for motors. A good supply of interchangeable parts is kept on hand with which to fix break-downs. The winding lathes and gear cutters are operated by separate C. G. E. motors.

STORAGE BATTERY FOR RAILWAY WORK.

It may not be generally known that the Berlin & Waterloo Street Railway Co. have in operation an 80 ampere storage battery manufactured and installed by the Gould Storage Battery Co., of Depew, N. Y. It consists of 255 type O 5 cells in glass jars, each jar containing two positive and three negative plates, the jars being of sufficient size to admit of 50 per cent. increase in capacity of battery. A booster of 65 volt 100 ampere capacity supplies difference in voltage pressure to facilitate charging of the battery. The battery is capable of supplying 160 amperes for short periods of peak of load, and is now set and working satisfactorily at the rate of maximum discharge. It is in circuit with the generator (100 k. w., with an additional one of the same capacity for emergencies), and in the manner indicated provides for fluctuations of load, thereby greatly easing the generator and engine.

With use of battery alone, all producing machinery stopping, the company have run one car continuously for four hours on their main line, which has maximum 4 per cent. grades, and at end of that time the indicators showed the battery to be easily capable of continuing for two hours more. Sunday morning cars are operated from the battery alone.

It is understood that the British Columbia Electric Railway Company intend to greatly increase the rolling stock of their road, and that the new cars will be built in the company's own car shops now in course of erection at New Westminster. The cars will be 22 feet in length, of the standard width, and will have seats facing forward instead of lengthwise. Upholstery is to be done away with as being unsanitary, the cars being finished in polished oak.

The Lindsay Light, Heat & Power Company are duplicating their plant at Lindsay, Ont., as a result of the rapid increase in their power and lighting business. When completed they will have about 1,200 horse power available for transmission from their power house at Fenelon Falls. A complete duplicate is being made of water wheels, generators, step-up and step-down transformers, switch-board apparatus and pole line, so as to enable the plant to be operated in unison or separately, as occasion may require, and at the same time reduce the chances of a stoppage of the system to the minimum. This company have adopted the meter system entirely.

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Correspondence is invited upon all topics coming legitimately within the scope of this journal.

The "Canadian Electrical News" has been appointed the official paper of the Canadian Electrical Association.

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The income of all our operating companies in Canada, railway, light and power, of necessity has to be obtained from the territory in which they operate, the earnings of each rising and falling coincident with the increased or decreased prosperity of its customers; in short, the companies are entirely dependent upon those immediately surrounding them for the wherewithal of their dividends. This being the case, should they not express their appreciation of the fact by making promotions in their various staffs, as opportunities occur, from among their own men, Canadians, who have put in many hard and weary hours on the lower rungs. It does not add to the value of a junior's services if he is led by examples in other places or by bitter experience in his own company, to feel that when a good position offers itself he is more than likely to be passed over in favor of a man, perhaps far from being his equal, who hails from across the border, but this is, alas, too often the case. There are a great many young men in this country, Canadian born and bred, who are the equals in every way of their competitors from the States. When the next vacancy occurs on your staff, even if it be that of Superintendent or Manager, give one of them a chance; we do not doubt for a moment but that the results will amply justify the giving of the opportunity.

Starting Synchronous Motors.

As is well known, the synchronous motor, which is under a great many conditions a most satisfactory machine once it is running and connected to the line which supplies it, is very hard to start, especially in small systems or in those cases where it is fairly large compared with the generator, on account of the heavy currents which it demands from the line, blowing fuses, and dropping the voltage all over the line, not infrequently to an extent sufficient to make other motors already running drop out of step and thus further complicate matters. To obviate this difficulty there are two methods of starting which are in general use today, namely, that of using a starting motor of the induction type, and that of placing in the circuit a compensator, or auto-transformer. Each has its own merits and each its own disadvantages, though if the synchronous motor cannot be disconnected from its work, or the major portion of it, by clutches or fast and loose pulleys, the former method is usually the most satisfactory. The induction motor is sometimes built direct connected to the other, the two armatures being on the same shaft, in which case the starting motor has to revolve all the time the main machine is running. This plan has the advantage in simplicity and noiselessness, but the starting motor is comparatively expensive, as it has to be of a speed which for its size is classed as slow. The alternatives to direct connection are belting and gearing, and occasionally a friction drive is found, though the latter has not proved itself a great success and is now being discarded. The belted machines are arranged in some instances to run coincident with the synchronous motor, no clutch or loose pulley being installed, though it is possible to throw the belt off completely, but in the majority of cases, where this drive is adopted one or the other of these devices is put in. For driving by gearing the best machine cut gears must be used, properly guarded to pre-

vent injury to attendants or the apparatus. The two machines are disconnected either by making the pinion to slide along the shaft until out of mesh, or by introducing an idle gear, which swung on the end of an arm and controlled by a lever working over a quadrant, serves to connect or disconnect the pinion on the starting motor and the gear on the main machine according as it is swung into or out of mesh with them. Another method is to mount the starting motor on a base which can be raised or lowered as desired, the pinion thus being engaged with or freed from the gear at will.

Exciter Driving

The question of providing satisfactory methods of driving the exciters for moderate-sized alternating current generators, without incurring excessive expenditures, is always a live issue, and the methods evolved for its solution have been many and varied. The first choice which has to be made is between separately driven units, equipped with a water wheel or engine or other driving power distinct from that which operates the alternator itself, and that type, belted geared or direct connected, which is driven from the same prime mover as is the machine which they excite. The latter as a rule are the cheaper, especially when the increased cost per horse power of the small machine which drives it is taken into consideration, but on the other hand, especially in plants with unusually large load variations, they are open to the serious objection that any change in this factor produces much larger voltage variation than would be the case if the exciter were separately driven, due to the fact that its speed and voltage varying simultaneously with that of the alternator, the latter gets less excitation than normal just at the instant it needs more, namely, when the load having suddenly become heavier, its speed is, momentarily at least,lower and the armature reaction greater. Exciters driven by separate water wheels are very satisfactory, though in systems operating under extremely high heads difficulties are sometimes experienced with the wheels choking up, as under the conditions of high head and small power the nozzles are very small, and but little debris is necessary to clog them. This difficulty has been overcome by adding to the unit an induction motor which is mounted on the same shaft as the other two machines, and is at all times connected to the main bus bars. If the wheel fails from any cause the motor still keeps the exciter going; if part of the load comes off the latter and the wheel tends to race, the induction motor prevents anything but a small increase in speed by acting as a generator and delivering energy to the bus bars. When the two machines are driven from the same source of power direct connection is most satisfactory, though the exciter is somewhat expensive, especially for steam plants where the speeds are low.

Next in point of desirability comes the belt drive, gearing being unsatisfactory on account of noisiness and rapid wear. Rotary converters and motor driven machines are sometimes installed—they both necessitate the presence of a running machine other than the one they excite, or some other independent source of E. M. F., otherwise the plant cannot be started, and in addition the former is open to the objection that any change in the generator potential means a corresponding change in that of the exciter, as the relation between its A. C. and D. C. sides is fixed, when the alternator needs a higher exciter voltage, that is, when the load has increased and reduced its terminal pressure, it receives a lower voltage, and vice versa. In steam plants the method of driving the exciter by its own engine is extremely satisfactory, although the steam consumption per horse power is somewhat higher than if the exciting power were generated by means of the large engine, which is sometimes named as the reason for the installation of motor driven sets. The situation may be summed up thus: Separately driven units are almost always to be preferred, motor driven sets are superior to rotaries, direct connection is more desirable than belting or gearing.

Single Phase Railways

The announcement is made that the Westinghouse Company have closed a contract calling for the equipping of some 55 miles of railway,between Washington and Baltimore, with a branch to Annapolis. The generator and transmission lines are to be alternating, as is common practice to-day where the distances to be covered extend over any considerable length, but instead of being multiphase, they will be wound for single phase currents only, a somewhat unusual feature, and when it is further noted that the motors in the cars are to be alternating and single phase at that, it will at once be recognized that if successful this installation will make a tremendous advance in the interurban railway field. The characteristics of even polyphase induction motors with regard to their starting torque, starting currents and efficiencies under partial speeds,have hitherto prevented their introduction in the railway field of this continent, though they have been used to a certain extent in European practice, and so we have been confined to direct current machines, the commutators of which have limited line potentials to the neighborhood of 500 volts. It will at once be recognized what a large saving will be effected by the new system in line copper alone when we are told that the potential on the motors is to be 1,000 volts. Further than this there is the great advantage that, the system being single phase, there will be only one trolley wire and its accompanying current collecting devices, the rails being utilized, as in direct current work, as the other conductor. The transmission to the substations, which will contain nothing but static transformers, and thus be much less costly than the standard rotary converter substation, will be at a potential of 15,000 volts, the transformers reducing this to 1,000 volts, at which pressure it will be delivered to the trolley, as stated above. The present intention is to mount four 100 h.p. motors on each car, which will weigh complete between forty and fifty tons, the equipments being figured for a speed of about forty miles per hour. The details of the method by which a single phase motor is made to give a performance hitherto unattainable even from multiphase apparatus, the particulars of the system of control, weights, efficiencies, etc., have not yet been made pubic ; these, and to a greater extent the results of actual operation will be looked forward to by railway men the world over, as if the undertaking prove a commercial success, and the standing of the Westinghouse Company goes far to ensure that it will, electric traction will be in a better position than ever to demonstrate its pre-eminence as the motive power of the future.

THE ROBB ENGINEERING COMPANY.

The Robb Engineering Company, of Amherst, Nova Scotia, are about to make extensive enlargements and improvements to their works. This step has been made necessary by the rapid growth of the business, the volume of which has nearly doubled within the last two years. It is proposed to erect next year a new machine shop 100x250 feet in size, and to re-arrange the other departments to the best advantage, placing the buildings so as to permit of their further extensions when necessary. The machine shop, boiler shop and foundry will be equipped with travelling cranes. A new electric plant will be installed to operate these cranes and many of the machines in the boiler and machine shops, as well as to light the works.

A walk through the works reveals the fact that the management is actuated by progressive principles. Every device calculated to reduce the cost of manufacture and render more perfect the product, is eagerly sought for and adopted. In some instances where a suitable device could not be found to perform a certain kind of work, the inventive genius of the firm has proved equal to the emergency. One of the latest of these inventions is the Robb-Armstrong Sweet governor, patents for which have been applied for in Canada, the United States and Europe. This new governing device is said to embody the advantages of the Sweet and Rice inertia governor and is so designed as to avoid friction.

The company have a most excellent system of preserving for ready reference the details of manufacture and tests of each engine turned out, so that any future troubles in operation can be promptly and certainly remedied.

Electric, hydraulic and pneumatic power are employed in the works, the first for lighting and power, the second for operating the heavy drills, and the third for operating the lighter drills, these latter being attached to flexible hose filled with compressed air, and thus made available for use at any place inside the shops or even outside.

The company have now nearly ready for shipment four engines for the Trinidad and one for the Demerara electric railways. They are each of 45 h. p. capacity. Last year they were honored by receiving an order from the Technical School of Manchester, England, for an engine which should exemplify the best features of American design and construction.



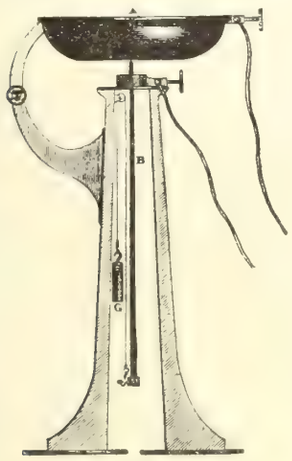
Ouiatchouan Falls, Near Lake St. John, Quebec.

DEVELOPMENT OF ARC LIGHTING APPARATUS FROM 1810 TO 1902.

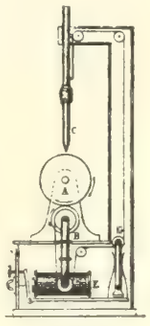
By W. D' A. Ryan.

(Continued from last month.)

In 1879 Werdermann of London introduced an incandescent Arc Light, in which the end of a small carbon pencil was pressed in contact with a large block or disk of the same material. A sufficiently heavy current was passed through the lamp to cause the small carbon to become incandescent. Occasionally a bad

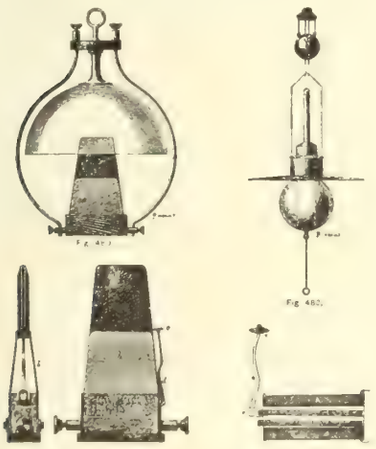


Werdermann's Lamp.

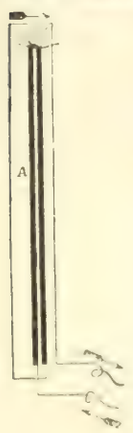


Harrison.

contact would cause a sputtering arc to form between the end of the small carbon and the block, but usually there was no arc at all. The efficiency of such a light was very low, and for this reason the Werdermann, Harrison and several lamps of this type met with little success.

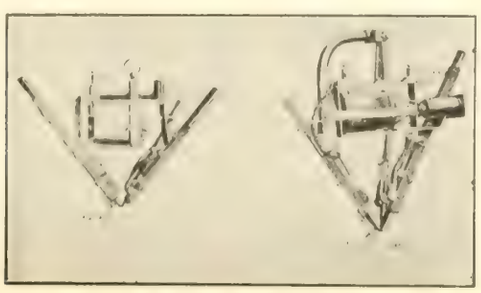


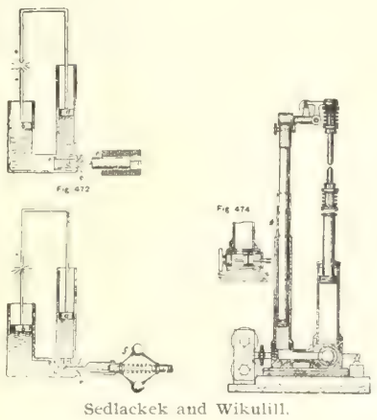
In 1879 Andrews, of England, attempted to get a long life from an electric candle by using large plates of carbon in place of rods. The arc was established by a stepping-stone igniter on the side of the carbons. This lamp was not successful, principally because the arc when any distance whatever from the edge of the carbons was almost entirely obscured.



In 1879 Jamain brought out his blow-pipe candle in which he made use of the attractive effect of the current to draw the arc up from the ends of the pencils in a fan shaped flame. He arranged a piece of marble, chalk, or lime so that the flame impinged thereon, thus producing a white light similar to the Oxygen-Hydrogen lamp. The candle was never developed to a point where it was considered practical.

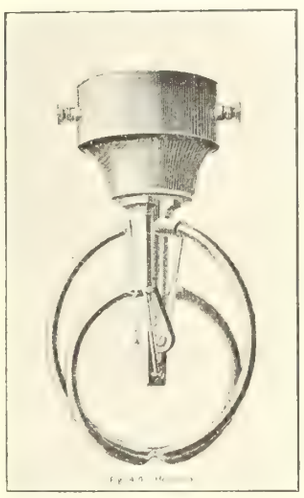
1879 Hedges London.





Sedlackek and Wikulill.

1879. Sedlaczek & Wikulilli. This is a peculiar type of lamp designed especially for locomotive headlights. The motion of the carbons is controlled by pistons floated in liquid, the feed being actuated by a magnetic or centrifugal governor. The principle was supposed to obviate the jar from the locomotive on the carbons. The lamps proved to be of little practical value.

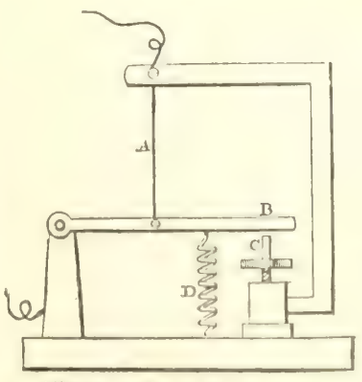


In 1879 Heinrichs, of London, designed a peculiar lamp in which the position of the arc was determined by the coincidence of the axis of curved carbon pencils. These lamps could be run in series, but owing to the expense of making carbons of this shape and to the unsteadiness of the light, the lamp met with little favor.



Fig. 580. Rapieff.

1897. Rapieffe, London, designed a candle similar to the Wilde except that the carbons were much longer.



Edison's Platinum-Iridium Lamp.

1879. Thomas A. Edison constructed a lamp in which a wire composed of platinum and iridium was run at a high temperature. The efficiency of this wire increases very rapidly as the temperature approaches the fusing point. The lamp shown is arranged so that when the wire has almost reached this point its elongation will cause it to cut itself out of circuit. On slight cooling the contraction will re-establish current through the wire. This apparatus while quite efficient could not be made sufficiently sensitive to avoid destruction of the wire. It was therefore abandoned.

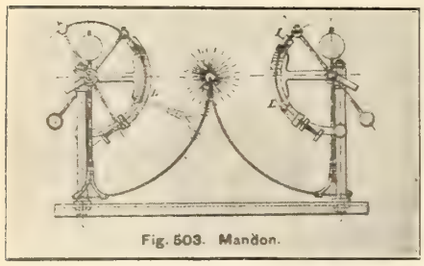


Fig. 503. Mandon.

In 1880 Mandon of Paris invented a novel type of lamp consisting of two quadrant electrodes balanced by counterweights rotating around fixed centres. Curved tubes containing mercury supported floats which raised the carbons as they were consumed. Ingenuity was the chief merit of this lamp. It had no practical value.

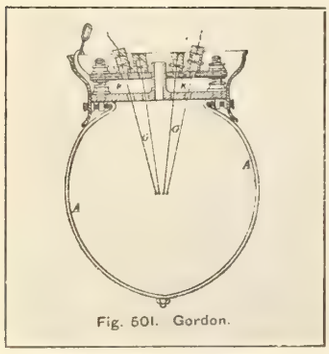
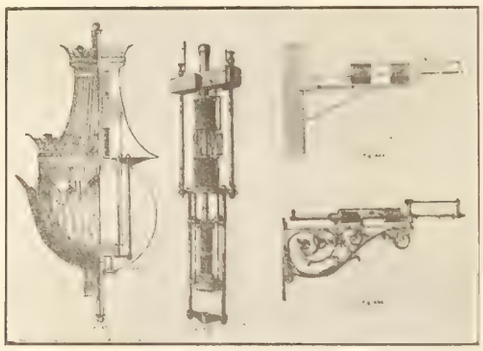


Fig. 501. Gordon.

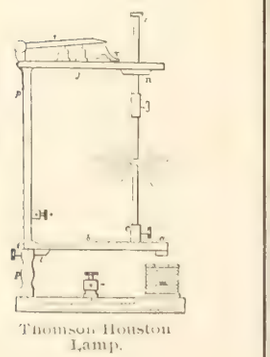
In 1880 Gordon of England invented a lamp in which the light was produced by rapidly alternating currents of high tension, discharged between knobs of refractory metal which became heated and emitted light.

The efficiency was very low and the light was of a bluish tinge. In 1880 and 1882 Krizik & Piette of Austria introduced the Differential Pilson Lamp in both the vertical and horizontal types. The former was provided with plate carbons for long burning. The horizontal type was designed for use in rooms



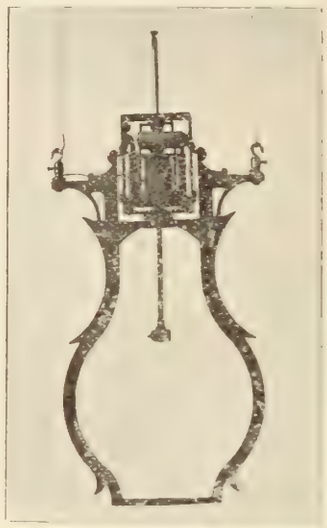
having low studded ceilings. The latter construction necessarily introduced a large element of friction and must of necessity have been more or less sluggish. This feature would have been sufficient to prevent the lamp meeting with any marked encouragement.

We will now depart from the European development entirely and confine our attention exclusively to progress in America, reviewing a few of the principal steps which lead up to the great success of both the Thomson-Houston and the Brush arc lighting apparatus which has established a world wide reputation. About 1878 Professor Elihu Thomson invented a lamp with current interrupter attached to the lower carbon, the object being to break the circuit many times per second so as to produce an inductive kick from the dynamo and line which would maintain an arc with a very feeble current. In 1878 this was followed by a shunt feed lamp in which the arc was established by a series magnet, drawing down the lower carbon, the upper carbon being held by friction wheels the pressure of which was released for feeding by a small relay. Only one lamp could be run on a machine.

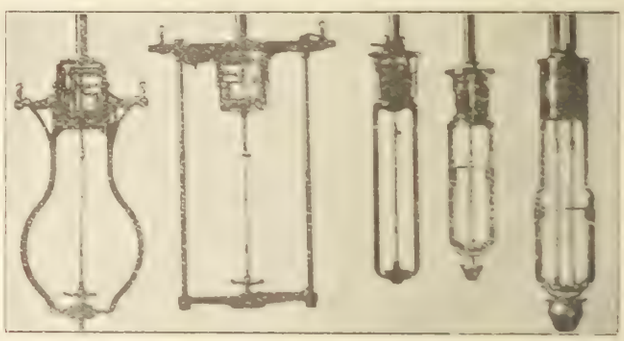


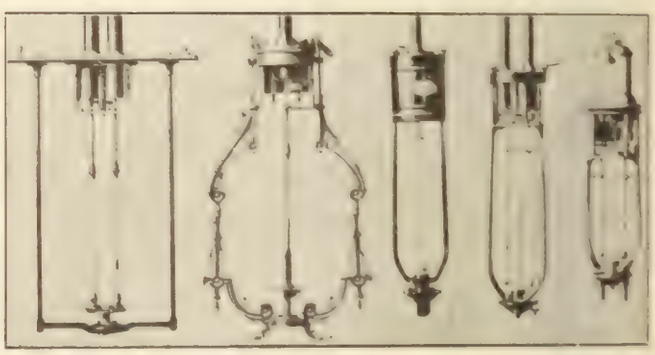
Thomson Houston Lamp.

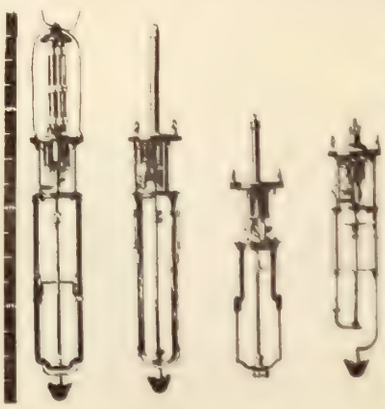




In 1880 the same inventor introduced a lamp having a series magnet in the upper part for establishing the arc. The top of the carbon rod was grooved so that when the carbons were nearly consumed the rod would drop through the clutch and short circuit the lamp, thus allowing the current to pass through the short circuited carbon tips and on to the other lamps in the circuit without interruption. Any number of lamps could be run in series. This was quickly followed by several designs of both differential and shunt Thomson-Rice Lamps with which many of you are no doubt familiar. A similar line of development was simultaneously carried on by the Brush Electric Company. The general tendency of both companies to reduce the diameter of the lamps, and the introduction of two carbons to give a longer life, is clearly shown in both cases. Single carbon lamps had a life of 8 to 10 hours and the double carbons from 16 to 20.







In 1892 and 1893 lamps were designed for operating on multiple lines commonly known as incandescent and power circuits. The Thomson 93 was one of the class. It was a very close regulating lamp and was unsurpassed for steadiness and brilliancy.

The first of these lamps were designed to run two in series on 110 volt direct current circuits, each lamp taking about 45 volts, the balance of the voltage being taken by a current steadying resistance installed in the top of each lamp.

So successful were the results that this line of lamps was immediately extended to alternating and direct current, series and multiple circuits representing all classes of service. The excellent quality of the light given by these lamps was due in a great measure to the use of high-grade carbons which cost from $30 to $40 a thousand, and a single pair had a life of about ten hours. The maintenance was therefore very high and furthermore the lamps were not adapted to individual control. As previously stated, two lamps were installed in series on 110 volt Direct Current Circuits so that when one lamp was turned out the other also was extinguished. In the case of railway circuits where ten lamps were run in series a cut-out was a necessary adjunct to lamps for this service and its function was to cut in a compensating resistance to hold current down as the arc went out so that the power consumed was constant independent of the number of lamps burning.

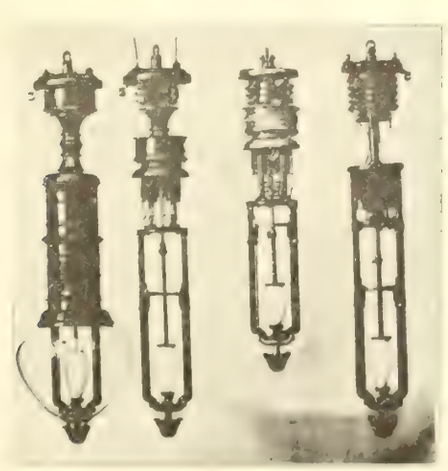
In the early part of 1894 simultaneous attempts were made by many engineers to resurrect some of the early unsuccessful laboratory experiments to construct a practical lamp which would burn 100 hours or more on a single carboning with the object of affecting economy in the cost of care and maintenance. It was also desirable to run the arc voltage much higher than would be possible in open air in order to accomplish the feature of individual control. Some early attempts were made to operate a Thomson '93 lamp with a small globe surrounding the arc. A cap was placed on the top of this globe and the upper carbon passed through a hole having a small clearance, thus practically excluding the oxygen and arresting consumption. While the life of the carbons was increased from 10 to approximately 100 hours, many difficulties were encountered. The carbons were not sufficiently homogeneous or pure to burn steadily without depositing a large amount of impurities on the globe ; furthermore, they were usually more or less crooked, cracked or blistered, and varied in diameter at different sections throughout their length. Feeding such carbons through a hole of small clearance was accompanied by unsteadiness in the light and frequent interruptions.

Furthermore, the art of enclosing globe manufacture had yet to reach a high stage of perfection. The glass usually varied in thickness and was not properly annealed, so that the breakage due to unequal stresses in the glass was great. This feature accompanied by the heavy deposit formed on the globes from the impurities of the carbon were obstacles which made lighting by the enclosed arc method seem almost impractical.

Pressure was at once brought to bear upon the globe manufacturers as well as the makers of carbons which resulted in a decided improvement in both directions, thus offering sufficient encouragement for bringing out lamps designed especially for long burning.

Thus from the beginning the successful development of arc lamps has depended upon the production of suitable carbon to use in them, and independent of any advance which might have been made towards the construction of suitable lamps for enclosed arc lighting such lamps would have been just as useless with the best carbons made ten years ago as a locomotive would be without steam.

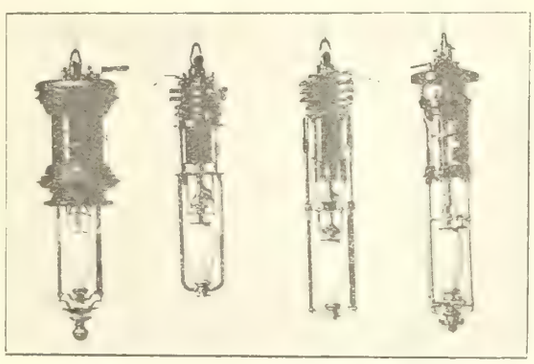
While the first step towards enclosed arc lamps brought out a wonderful simplification of the mechanism, little was done towards improving the aesthetic qualities and the lamps were just about as long and cumbersome as the open arc lamps which they were so soon to supersede. Just so long as the carbon rod remained the lamp could not be materially shortened, but during the years of 1896 and 1897 some manufacturers in an

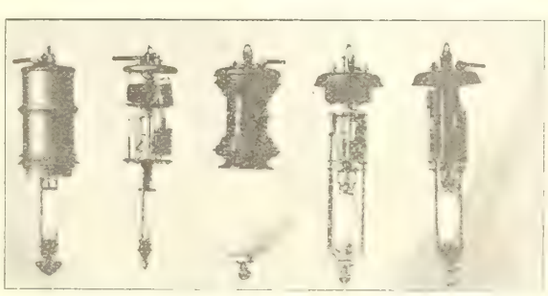


attempt to get a short lamp abolished the carbon rod and allowed the clutch to act directly on the carbon pencil. This was an exceedingly venturous step at the time; notwithstanding that carbons had undergone a wonderful improvement to accommodate them to the long burning feature, they were still far from perfect and many troubles were experienced in trying to work the clutch directly on an uneven surface.

It was not long, however, before the carbons underwent a further improvement, and were made practically free from cracks or blisters, were straight, and did not vary more than .015 to .020" in diameter, so that there no longer existed any question as to the possibility of satisfactorily operating a clutch directly on the carbon. In fact, all modern lamps are now constructed on this principle. The earliest direct current lamps were of the solenoid type, which were difficult to insulate and somewhat troublesome to assemble and keep in alignment. This usually resulted in a variable friction.

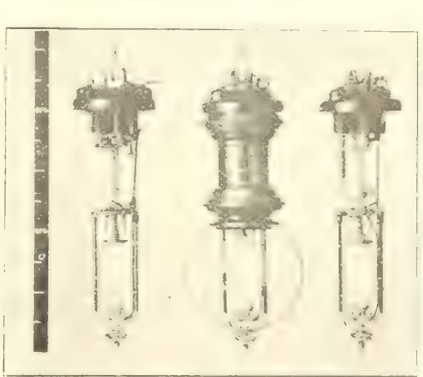
About 1897 construction dropped back to the electro-magnetic principle used in the first enclosed arc lamps having carbon rods such as the Marks-Ayer, early General Electric and others. This seems to be the most substantial mechanical construction. Lamps

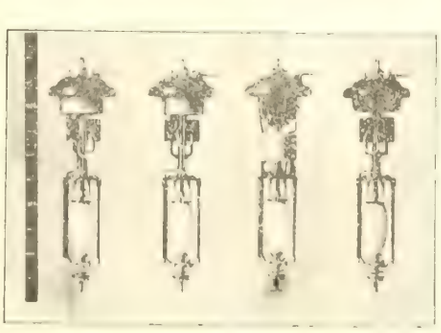




of this principle are used on all forms of direct and alternating current, series and multiple circuits. Practically the only difference between the direct current and the alternating current multiple lamp is that the former uses two solid carbons and has a dead resistance for steadying the arc and regulating the voltage, while the latter burns one cored and one solid carbon and has a laminated armature, and a reactance is substituted for the dead resistance. Electric arcs are a little more sensitive to alternating current than direct, owing to the rapid interruption in the former. The reactive coil has a steadying property not possessed by a dead resistance. This gives the lamp a good margin of stability beyond the chattering point; furthermore, it is less wasteful of power.

Before concluding the subject of arc lamp development I would like to add a word or two on a few of the essential features to be carefully regarded in modern arc lamp engineering, which class





of engineering is quite, if not more, difficult than any other branch of electrical work. A 100 light dynamo might possess faults which would or would not be apparent to the dynamo

operator, but the 100 lamps spread over a large territory and operated by this machine would be open to the criticism of every body in the vicinity, including every policeman on patrol, who usually seem delighted to carry back to the police station a report that such and such a lamp chattered or went out. This usually means a reduction in the lighting company's bill of so much per light out, as covered by many lighting contracts. The lamps are therefore open to the criticism of the public, while the machine is open to the criticism of an individual or two; further, if the fault in the dynamo is of such a nature as to show itself in the lamps, the latter will come in for the blame anyhow.

In the development of modern arc lamps the engineer is required to give careful attention to the following points :—

First :—Aesthetic.—The lamp in general design and contour must be symmetrical, well balanced, and pleasing to the eye. Extremely broad or very slim design should be avoided and features of difficult design or manipulation in production should not be introduced.

Second.—Ventilation.—While adhering to the point just mentioned due regard should be given to the ventilation, so as to allow proper convexion and radiation of the heat dissipated in the arc and lamp coils.

Third.—Mechanism.—This should be as simple as possible, due care being given to modifying the design so as to have the smallest number of movable parts, thus avoiding friction which is more or less in evidence in all lamps and should be minimized as far as possible, consistent with substantial design.

The magnets and their armatures should be so proportioned as to give an even pull throughout a wide range in order to maintain the voltage in the case of series lamps and current in the case of constant potoential lamps practically constant.

The wire used in the coils should be sufficiently liberal in its cross section to avoid overheating. Small diameter coils are to be preferred to thick ones, as the latter hold the heat and the temperature of the inner layers of the thick coils rises to a much higher degree than those having a smaller depth of wire.

In alternating lamps the magnetic parts should be of high permeability and properly laminated, so as to reduce the heating by Foucault and Eddy currents, and provision must be made for taking up the rapid vibrations of the armature core in a way to avoid undue humming.

There is an inherent hum in the arc which it is impossible to avoid, but by proper design the humming of the cores and rattling of the mechanism can be almost entirely obviated.

The dash pot, a necessary adjunct to all lamps, is a feature of considerable importance. Without this the lamps will not start well and will be liable to chatter or surge on series currents.

Under certain well balanced conditions a lamp will operate without a dash pot, but it has not been found practical in any design so far attempted to do away with it entirely.

The strength of this dash pot must be so proportioned that it will start the lamp without a momentarily excessive rush of current, which always follows when the dash pot is too stiff.

In the same direction we have the mechanical danger of having the plunger fit too tightly in the shell and it is liable to stick.

On the other hand a weak dash pot will cause excessive chattering when the lamp starts, and it is considerable of an engineering problem to strike the proper point midway between the two evils; furthermore, owing to the constant heating and cooling of the lamp the dash pot shell frequently loses its original shape and binds.

If the engineer has had sufficient experience he will know how to make these dash pot shells so that they will be reasonably permanent in shape by giving great care to the composition of the metal selected and to the temperature at which it is worked and the method of mechanical manipulation. Plungers have been made of brass, phosphor-bronze, German silver, carbon, graphite, soap-stone and various substances. In all cases it has been found that two dis-similar metals work better together.

All the above metals have their advantages and dis-advantages, but an especially prepared form of graphite has been found to be the most reliable. At least this is the decision arrived at by a leading manufacturer based on the merits of operation of over 300,000 enclosed lamps, in fact, if I include the open arc lamps, I might safely say 700,000.

The clutch should be extremely sensitive and at the same time positive in action so that it will feed on a small variation in voltage and at the same time will not permit the carbons to slip through under excessive jarring.

The carbon holders should be carefully designed, and the method of carrying current to these holders should be flexible and positive and the leads should not be liable to entanglement with other parts of the lamps.

Trimming should be simplified and all parts should be substantial so as to stand fairly rough handling, if the lamps are unfortunate enough to receive it, and they usually do.

The insulation should be concentrated at the fewest possible points and should be reasonably high and all external parts of the lamps should be dead.

It is also very important that the design permit of easy alignment. And further it goes without saying that a lamp which cannot have a small part repaired without tearing it all to pieces is hardly to be considered at this period.

While endeavoring to maintain all the above features at the highest degree of excellence, the manufacturers in their work of simplification and improvement have given due care to manufacturing lamps of various types as similar as possible in design consistent with the various classes of circuits on which they are to be operated. This is of the utmost importance to central station men, as the lower frames, tops, centre tubes, globes, carbon holders, etc., can be used on any of the different types and by slight modifications any one of the lamps can readily be converted for use on any of the various circuits.

While it has cost thousands of dollars to mould the different lamps into similarity, yet this cost to the manufacturer has been offset by a material reduction in the cost of production owing to the greater number of similar parts which can be manufactured at one time, thus greatly facilitating handling of stock and the distribution of parts to the various departments employed in the manufacture of apparatus.

The advantages from this important achievement of modern arc lamp engineering have been manifold and all have benefitted thereby.

Mr. Ryan supplemented the above paper by a brief treatment of the "Relative Merits of Open and Enclosed Arc Lamps", illustrating the various points with candle power and illumination curves. The lecture was concluded with a number of experiments with light by the use of such instruments as the polariscope, spectroscope and other projection apparatus.

PRICES FOR ELECTRIC CURRENT IN GERMANY.

Light and power are delivered by the Actiengesellschaft Elektricitats, Hagneck, Switzerland, station under the following conditions:

TARIFF FOR INCANDESCENT LAMPS.

	10 C.-P. Fcs.	16 C.-P. Fcs.	25 C.-P. Fcs.	32 C.-P. Fcs.
More than 1,000 hours per year.	13.50	21	33	42
400 to 1,000 hours per year....	10.50	16	25	32
400 hours per year	7	10.50	16.50	21
With motors, minimum rate ...	2. 0	4.50	7	9

Rate for use, 0.35 Fc. per kilowatt-hour.

TARIFF FOR ARC LAMPS.

Pressure about 35 volts.

135 Fcs. per year and per lamp of from 10 to 12 amperes.
180 " " " " 15 " 17 "
225 " " " " 20 " 22 "

TARIFF FOR ELECTRIC MOTORS.

Class A, applicable to motors operated eleven hours per day.

$\frac{1}{10}$ h.-p., Fcs. 270 per h.-p. and per year, Fcs. 27.00
$\frac{1}{4}$ " " 245 " " " 61.25
$\frac{1}{2}$ " " 225 " " " 112.50

One to 100 horse-power and more according to contract.

Class B, applicable to motors operating continuously day and night.

The prices mentioned above, with an increase varying up to thirty per cent. according to the duration of the work.

Class C, applicable to motors operating only during the day, and not during the hours of lighting.

The prices given above with reduction of thirty per cent.

Class D, applicable to motors not included in the former classes—motors operating with great changes of load, railway motors, etc. Special agreements are made in each case in consideration of the character of the work.

TESTS OF A HIGH TENSION SWITCH.

Some interesting tests of a high tension switch were recently made at the Colgate power house of the Bay Counties Power Company, in Yuba County, California. A single-pole switch was connected directly across the 40,000-volt bus-bars that were receiving current from generators having a rated capacity of 7,500-kilowatts through transformers of equal capacity. This switch was closed and opened ten times in the space of two minutes and it opened the dead short circuit each time safely and easily and without damage to the switch, transformers or lines.

One of the two bay lines that were in parallel was then cut out at Colgate, but left in parallel with the other at a station 120 miles from Colgate, and the switch connected across this line, thus giving 240 miles of line between the switch and bus-bars. The switch was closed and opened fifteen times in the space of three minutes, and it opened the short circuit each time safely and easily and absolutely without damage to transformers or lines. The switch opened the short circuit the twenty-fifth time fully as well as the first time, and was not at all damaged by the extremely severe test of opening a dead short circuit at 40,000 volts, with generator and transformer capacity of 10,000 horse-power behind it, twenty-five times.

The Slade Electric Company, of Quebec, are installing electric light in the Roman Catholic church at Sillery. The same firm have just completed the installation of 2,500 lights in the Chapel of the Ursulines, Parlor street, Quebec.

NIAGARA FALLS GENERATING PLANTS.

In a paper presented at the last convention of the American Institute of Electrical Engineers, Mr. H. W. Buck, consulting engineer for the Niagara Falls Power Company, gave a description of the generating plants now being installed at Niagara Falls and of the plant on the Canadian side of its allied company, the Canadian Niagara Power Company. The latter plant will be located in Queen Victoria Park, about 1,500 feet above the Horse-Shoe Falls, the intake canal, wheel-pit and discharge tunnel leading to the foot of the falls.

The unit in this plant will be of 7,500 kilowatts capacity, and the generators will be wound for 12,000 volts three-phase. The frequency will be retained at 25 cycles for the sake of uniformity with the American plants so as to permit of parallel operation. In selecting a unit of this large size, the American and Canadian systems were regarded as one. Since this is likely to reach ultimately an output of several thousand horse power, a unit of 10,000 h.p. is not a large proportion of the whole, and is not too large an amount of power to concentrate in one machine from the standpoint of convenience. The principal advantage in a unit of this size over the smaller one is, Mr. Buck points out, in the reduction in cost of development per horse power. This reduction in cost results from :

1. Lower cost of generator per horse power.
2. Lower cost of turbine per horse power.
3. A 10,000 horse power unit only occupies slightly more space than one of 5,000 h.p. capacity, which results, for a given plant output, in great reduction in length of wheel-pit, power house and fore-bay, and a consequent reduction in construction.

The generator is shown in assembly in Fig. 1. It is of the internal revolving field vertical shaft type, of General Electric manufacture. Its revolving field ring

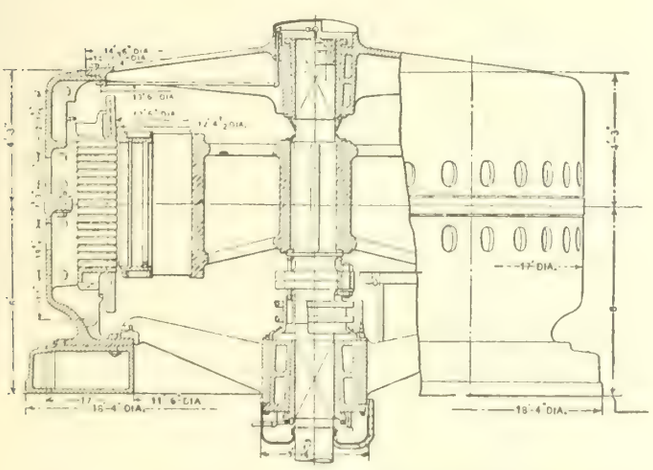


FIG. 1. 10,000 H. P. THREE PHASE GENERATOR, CANADIAN POWER HOUSE.

is built up of punched laminations, bolted together with joints lapped. This method of construction gives a uniform and definite strength of ring and high magnetic permeability. On account of the high speed, 250 r.p.m., the generator is very small as compared with some of the large engine-driven units, its over-all diameter being about 19 feet. The weight of the revolving part of the machine is 141,000 pounds, with a fly-wheel effect at 250 r.p.m. of 2,000,000,000.

The generator has to be wound directly for 12,000 volts three-phase, instead of 2,300 volt two-phase, as in the American plants. This high voltage was selected, not for long distance transmission but for economy in distribution to power users near the power house. In distributing large amounts of power underground from a 2,300 volt two-phase plant, after a radius of about one mile is exceeded, it becomes cheaper to transform to 12,000 volts three-phase and distribute at this voltage than to supply power directly at 2,300 volts. From this it becomes

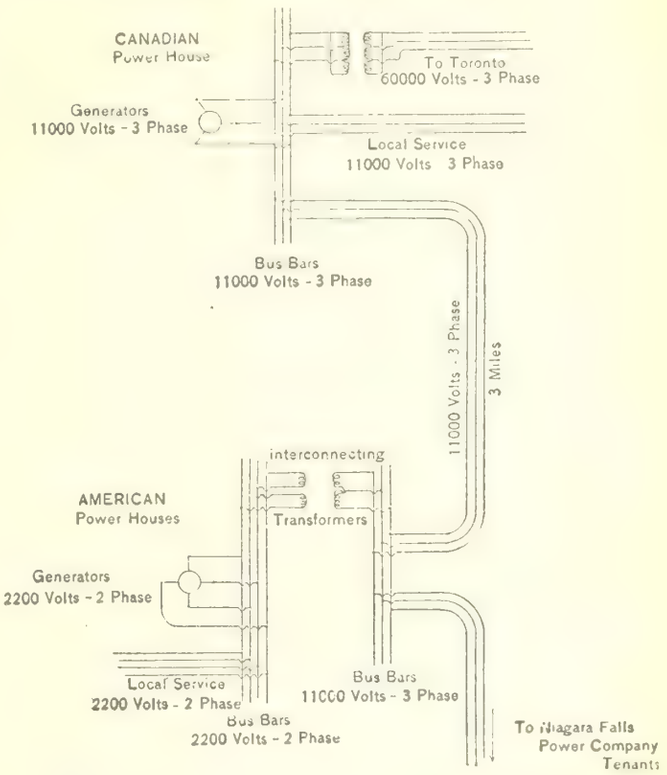


FIG. 2. -METHOD OF INTERCONNECTING CANADIAN AND AMERICAN POWER SYSTEMS.

evident that great economy results from the direct generation of the higher voltage. For long distance transmission step-up tranformers will be used to raise the voltage to 22,000, 40,000 or 60,000 volts.

Fig. 2 show the method which will be adopted for operating in parallel the American and Canadian systems. The connection will be made by triple conductor cables carried across the upper arch bridge over the Niagara Gorge. The paralleling will be done through step-down Scott connected transformers.

Satisfactory progress is being made on the power tunnel between Lake Beautiful and Coquitlam Lake for the Vancouver Power Company. Mr. W. Meredith is consulting engineer and Messrs. Ironside, Rannie & Campbell the contractors. A tramway for hauling supplies is also being constructed.

The St. Francis Power Company has been organized to develop a water power at Disraeli, on the Quebec and Central Railway, between Sherbrooke and Quebec. This power is situated near to Black Lake and Thetford Mines. It will be possible to develop about 2,000 h. p., which it is proposed to transmit electrically to power users in the locality. The Thetford Mines alone use about 2,000 h. p. and are said to be now operating very uneconomically by means of small steam engines, which are not only inefficient and uneconomical, but require a man to be in charge of each one. The company are also said to be paying about $4.50 a ton for coal, so that the cost per h. p. for 24 hours will probably amount to $100. By using electric power the company could probably reduce the cost by about one-half. Messrs. Ross & Holgate, consulting engineers, of Montreal, have been employed by the power company to prepare the plans for the utilization of the power. The company are said to have secured the ownership of all water powers within a radius of thirty miles from Disraeli.

ENGINEERING BUILDING QUEEN'S UNIVERSITY.

The Engineering Building now in course of erection at Queen's University, Kingston, will contain the central heating and electric plants and the departments of Civil, Electrical and Mechanical Engineering. Provision will also be made in this building, temporalily at least, for the Department of Forestry and Botany.

The boilers, which are to supply steam for heat and power to all of the various college buildings, will be located in a suitable wing connected to the east end of this building. The boilers will be of various types representing the best practice. The students will thus get a practical knowledge of the different types usually found in recently constructed plants. One boiler will be fitted specially for testing and experimental work, capable of carrying a pressure of 200 lbs. and supplied with a superheater. The draft will be obtained by two fans direct-connected to two separate engines and working in parallel.

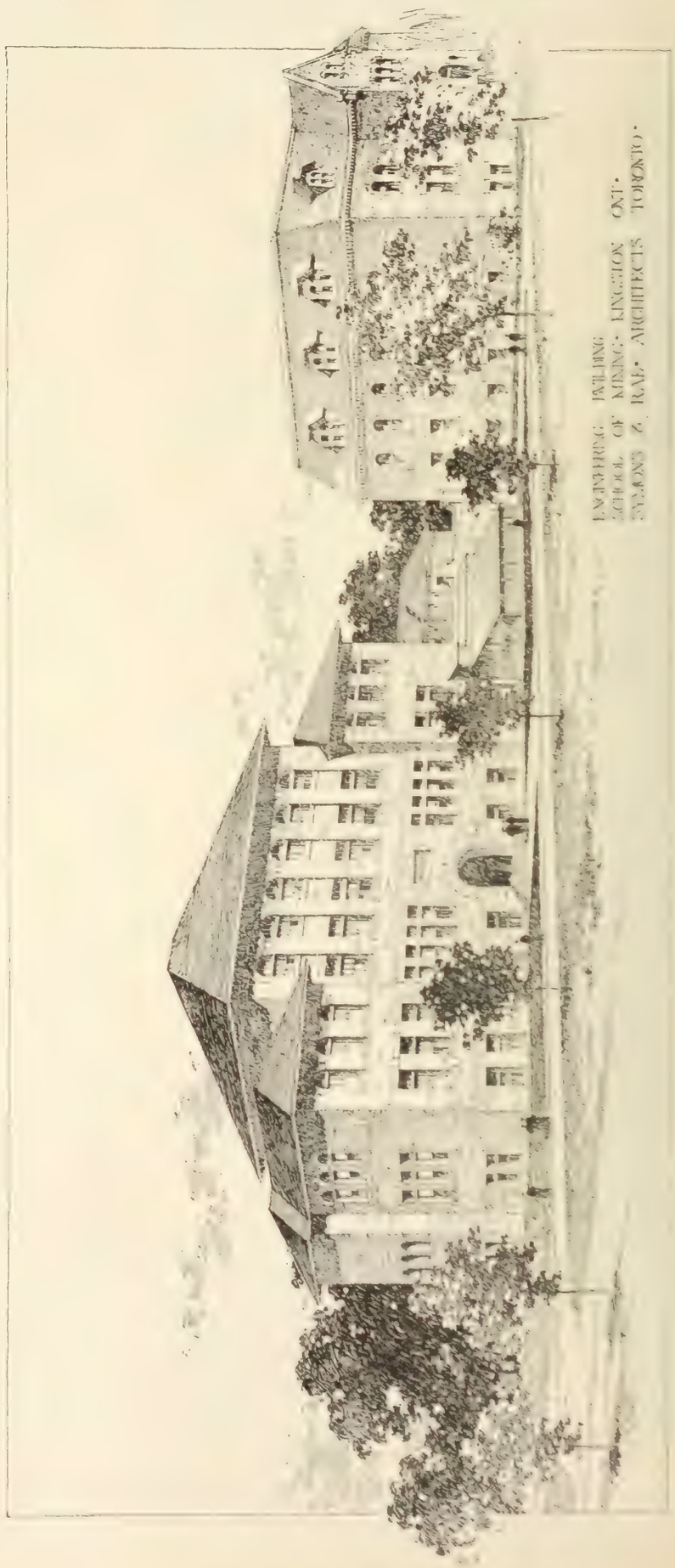
The electric plant will be placed on one side of the main building adjoining the boiler room. This plant will supply all the electricity required for light, power and experimental work.

Adjoining the electric plant on the south side of the basement are a storage battery room and three laboratories for experimental work in electrical engineering. The storage battery will be of sufficient capacity to light the college buildings in the evening when required, and when the electric plant will not be running. It will also be used very extensively for experimental purposes. The laboratories will be equipped with the most improved types of generators, motors, transformers, etc.

On the north side of the basement and adjoining the boiler room are two laboratories for experimental work in thermodynamics and mechanical engineering. These laboratories will be equipped with the latest types of steam and gas engines, compressed air, etc. There will also be a laboratory in the basement for measuring the strength and elasticity of materials.

The first floor will contain the various botanical laboratories, lecture rooms, library, cloak rooms and janitor's room. On the second floor will be the engineering lecture rooms, library and research room. The third floor will be devoted entirely to draughting, with the exception of two small rooms for blue-printing and photographic work.

A five year contract for the supply of electric power to operate the new pump at the high level waterworks reservoir in Montreal has been awarded to the Lachine Rapids Hydraulic & Land Company. The price is $20 per horse per year, making the cost for 400 h. p. for the period mentioned $40,000.



QUESTIONS AND ANSWERS

"A. S.", Houston, Minn.: Would you please give answers to these questions in your October issue? (1) What would be the number of the wire you would use for the mains of an incandescent lamp circuit, carrying current for fifteen-hundred incandescent lamps, the voltage of each lamp being 110, and the candle power 16? (2) What would be the necessary capacity of the dynamo used to run the above circuit? (3) What would be the horse-power of a steam engine used to run the dynamo, when the dynamo is loaded to its full capacity?

Ans: (1) In the absence of advice as to the relative location of the lights and the distances between the various groups, also as to the character of the system, direct or alternating, two wire or three wire, single phase or multiphase, it is impossible to answer you intelligently, though we presume it is alternating three wire, in which case it will usually be found desirable to locate your transformers so that the largest wire required will not be over No. 4 or No. 6. (2) Assuming that you are using lamps consuming 60 watts each, the machine would need to deliver to the lamps 60x1500 = 90 k.w. Allowing for line losses, and also for those in the transformers if your system is alternating, the generator would need to have a capacity of 100 to 110 k.w., these figures being based on the supposition that all the lamps are burning at once; if this is not the case they can be reduced accordingly. (3) Assuming that the dynamo is delivering 100 k.w. to the line, and that the combined efficiences of it and the driving mechanism is 85 per cent., the engine would need to deliver $100 \times \frac{100}{85} \times \frac{1000}{746} = 157$, or say 160 horse power.

"Reader" asks: Does a three-phase generator wound for 10,000 volts mean that each phase used separately gives 10,000 volts, or does it mean 10,000 volts between each of the three wires on the three-phase transmission line?

Ans: If the windings of the generator are connected delta or mesh fashion, they are each designed to produce the rated potential of the machine, in your case 10,000 volts, and if they were used separately each as an independent single-phase system they would each give this pressure, but if the machine is designed with its windings connected star, the three windings each then produce only $\frac{1}{\sqrt{3}}$ or .577 times that of the terminal voltage of the generator, which would in this case be 5,770 volts. These connections you will note are in all cases made in the machine itself, and do not affect the outside line, which in either event has 10,000 volts between any two of the three wires composing it.

"J.B.": Is 50 cycle three-phase apparatus one of the standards or is it likely to become the standard for light and power work? Do 220 volt lamps flicker on a 50 cycle circuit?

Ans: Apparatus of this frequency is not standard on this continent, nor do present indications point towards its coming into more general use, though there are, of course, some plants installed here; it has been used quite frequently in European practice. 220 volt incandescent lamps are satisfactory on 60 cycle circuits, though they begin to exhibit flickering when run at a frequency of 40. We do not know of any 50 cycle plants which are using them, though it is probable that they would give satisfaction, except perhaps in situations where there was a fast moving object in front of the light.

"R. S.", Halifax: Can I use ammeters and wattmeters built for testing on 110 volts for 2,080 volt primaries?

Ans.—We see no objection to your using ammeters in this way, provided precautions are taken to insulate the case from the ground, as it is possible that the insulation in the instrument is not sufficient to withstand the tendency to ground, especially if there be any leaks in the primary line. The wattmeters can also be used in this way, a potential transformer being inserted in the voltage leads so as to bring the voltage across them within the limits of the instrument. The reading will naturally have to be multiplied by the ratio of this transformer.

"Dynamo" asks: Can I use an enclosed arc lamp, 6.6 amperes, for series circuits, on the same lines as open arc lamps?

Ans.—Yes, there is no objection whatever, provided the amperage is the same. You should note that the open lamp takes 50 x 6.6 = 330 watts, while the enclosed type consumes 80 x 6.6, or 528, which means that the change results in your furnishing lamps of a larger power consumption than was probably contracted for, or in other words, that the lamp capacity, though not the actual ontput of the machine, is reduced in that proportion.

W. H. Smith: What is the difference between the terminal and the receiver pressure of a steam engine?

Ans.—The terminal pressure is that in the cylinder at the expiration of the stroke, just before the opening of the exhaust valves. The receiver pressure, as the name indicates, is that in the receiver or chamber between the cylinders of compound engines.

"Subscriber": How can I be sure that the connections of two machines are correct for running in parallell? What will happen if one starts to run as a motor?

Ans.—The simplest way to make absolutely certain that everything is in readiness for parallell operation is to raise the brushes or otherwise open the armature circuit only of one machine, and then to close all the switches, thus exciting its field from the other generator. If, now, the switches be opened and the second armature circuit closed both machines will come up with the correct polarity. If when they are running in parallel one field gets weak and that machine starts to run as a motor nothing special will happen, provided the field does not get too weak and thus too much current flow. If it does, the fuses or circuit breakers will operate, and save the equipment from actual damage.

"Power House Assistant" asks: What is the little curl of pipes found under nearly all steam guages put there for?

Ans.—It is used to retain water, condensed from the steam, which cannot get away because it cannot run over the uphill portion of the circle. Such a device should always be installed with every steam guage, as the entrapped water prevents the hot steam from reaching and damaging the instrument.

TELEGRAPH and TELEPHONE

THE BELL TELEPHONE COMPANY IN TORONTO.

In order to meet the requirements of their growing business in Toronto, the Bell Telephone Company have found it necessary to enlarge their Exchange on Temperance street. The addition, which is now under way, consists of a new building 45 by 80 feet, and in external appearance an exact duplicate of their present building. The upper flat of the new building is intended for operating purposes, and in it will be installed a new central energy switchboard. After the present subscribers have been transferred to the new board, the wall dividing the two buildings will be taken down and the present operating room used for the accommodation of the long distance switchboard and the future growth of the business. The new board will have a capacity of 8,000 subscribers, or nearly double that of the present board.

As the North Toronto and Parkdale branches are already equipped with central energy type switchboards, the inauguration of this system at the Temperance Street Exchange will place the entire city on an absolutely modern system, by which the ringing of the bell when calling Central will be done away with.

The second storey of the combined building will be devoted to the power plant and distributing departments, and the business offices, now on the second floor, will be removed to the ground floor. Increased accommodation will also be provided for the operating staff.

When the extension is completed, the Exchange will be sufficiently large to provide for the prospective growth of the company's business for some years to come, and in point of equipment it will be second to none.

RESIGNATION OF MR. ARTHUR COX.

Within the past month the announcement was made of the resignation of Mr. Arthur Cox, superintendent of supplies and treasurer of the Great North-Western Telegraph Company. For personal and private reasons Mr. Cox decided to sever his connection with the company, with which he had been connected for 27 years. It is his intention to return to England.

Mr. Cox came to Canada nearly thirty years ago, with the intention of following his profession as an artist, but finding the talent of the artist not appreciated in Canada as the calling deserved, he turned his attention to a commercial life. Obtaining a situation with the Great North-Western Telegraph Company, he was quickly promoted from one position to another, until finally receiving an appointment to the dual position of treasurer and superintendent of supplies. These are two of the most important positions in the gift of the company. The supply department, which has to cater for 2,000 offices, has been, under Mr. Cox's supervision, created into a model of methodical and precise management. The ability shown by him in the discharge of his duties was frequently commended by the management.

Mr. Cox is also an inventor of some note, one of the most valuable of his inventions being "Cox's Patent Infold", an ingenious device which, in one sheet, serves the double purpose of telegraph blank and envelope. This combination is used by all the Great North-Western Telegraph Company's offices.

The loss sustained in the removal of Mr. Cox is keenly felt by the company. In a personal letter to him Mr. H.P. Dwight, president and manager of the company, expressed his deep regret that he should have decided to retire from the company, at the same time referring to the satisfactory manner in which he had discharged his duties. At the annual meeting of the company held a fortnight ago a resolution was passed laudatory of the faithful services and abilities of Mr. Cox, who in his new field carries with him the hearty wishes of numerous friends in Toronto.

Mr. G. D. Perry, secretary and auditor of the company, succeeds Mr. Cox, having been appointed secretary-treasurer and superintendent of supplies.

OLD-TIME TELEGRAPHERS' ASSOCIATION.

The twenty-second re-union of the Old-Time Telegraphers and Historical Association and the Society of the United States Military Corps was held at Salt Lake City, Utah, on September 10, 11 and 12. About 200 members were in attendance and a meeting of profit and pleasure was the result. The report of the secretary-treasurer showed a membership of one thousand, with a large list of applicants for membership. The age limit for admission was raised to 25 years. This action was deemed necessary in order to keep the membership down to a reasonable limit. Milwaukee was selected as the next meeting place, in September, 1903. The executive committee was enlarged and now stands as follows: L. B. McFarlane, Montreal; G. H. Corse, Ogden, N. Y.; H. C. Hope, St. Paul; H. J. Pettingill, Boston.

SHORT-CIRCUITS.

Hamilton Bros. have a telephone service between Singhampton and Glen Huron and the station at Smithdale. It is now proposed to extend the system to Collingwood.

The Nipissing Telephone Company, of Sturgeon Falls, Ont., has been incorporated, with a capital of $5,000. Messrs. C. W. Rantaul, jr., and A. J. Young are directors.

Mr. J. C. Shields, of Ashcroft, B. C., has secured from the Dominion Government the contract for the construction of the telegraph line between the 150-Mile House, Cariboo, and Quesnell Forks. The distance is about 70 miles.

Mr. Anselm Boyer, C, E., has been appointed superintendent of Government telegraph and cable lines in Quebec and the Maritime Provinces. Mr. Boyer was one of the engineers who laid out the route of the telegraph line to Dawson.

A company has been formed in Lafayette, Ind., to manufacture a pocket telephone. The receiver is shaped so that one hears and talks in it. An aluminum box is fastened to a telephone pole, a key fits this box, and, when inserted, calls the telephone exchange. It is claimed that the invention will be of great utility in cities for policemen in summoning help or sending fire alarms, and can be used on street car lines.

The Great Nothwestern Telegraph Company held its annual meeting in Toronto recently, at which directors and officials were elected as follows: H. P. Dwight, president and general manager; Adam Brown, vice-president; H. N. Baird, Col. R. C. Clowry, Richard Fuller, James Hedley, A. S. Irving, and W. C. Matthews, directors; Geo. D. Perry, secretary-treasurer and superintendent of supplies; A. C. McConnell, auditor.

After wrestling with the telephone question for some months, a special committee of the Ottawa city council has recommended that the council enter into an agreement with the Bell Telephone Company for the continuation of a telephone system. The ratepayers voted in favor of the establishment of a civic telephone system, but apparently the accomplishment of this was surrounded by too many obstacles to be undertaken by the council. The Bell Company will probably be asked to enter into a new agreement more favorable to subscribers than the old one. A rate of $40 per annum for business places and $25 for residences, with a reduction of $20 where three year contracts are entered into, is spoken of.

THE PREFERENTIAL TARIFF.

The news comes from Berlin that the German customs authorities will in future require certificates of origin in the case of American grain. This is regarded as a retaliatory slap at Canada for having granted preferential duty on British goods coming into this country. The Dominion should now demand a certificate of origin in the case of all imports from Great Britain. This would have the effect of shutting out large quantities of German goods which now find their way into Canada as British imports and get the benefit of the preference which was intended to apply only to British manufactures. The statement is made, on what appears to be good authority, that many German manufactured goods are shipped into England, where the assembling of the parts is done, after which the goods are exported to Canada and receive the benefit of the preference. At present there is nothing to prevent such a practice either by Germany or other countries. Means should be adopted to prevent the preference being accorded to any but bona fide British goods.

EXHIBITS AT TORONTO EXHIBITION.

In our notes in last issue on the display in the Machinery Hall at the Toronto Industrial Exhibition two exhibits were inadvertently overlooked. The most conspicuous exhibit, perhaps, was that of the Canada Foundry Company, which is controlled by the Canadian General Electric Company. Their display occupied a space extending along the entire side of the west end of the building. Behind snow white columns was an elaborate display of the products of the company, including waterworks supplies, combination and single drinking fountains, ornamental iron work, wrought iron fences, etc. An interesting feature was a freight car truck, one of an order of one hundred for the Canada Northern Railway; and another object of interest was a sample of the great forges, part of the equipment of the new forge shop of the Canada Foundry Company at Toronto Junction. There was shown an automatic cold pressed nut machine in operation, claimed to be the only one of its kind in Canada, and an automatic screw machine making 3x½ cap screws. At night the exhibit was brilliantly illuminated by the latest type of C. G. E. enclosed arc lamps.

The A. R. Williams Machinery Company had a good display of iron and wood working machinery, machinists' tools, etc.

AQUEDUCT THROUGH A MOUNTAIN.

The Vancouver Power Company, a corporation allied to the British Columbia Electric Railway Company, which owns all of the tramways in British Columbia, will soon undertake a novel piece of hydraulic engineering work in connection with an electric transmission project. A water power electric generating station is to be located near the headwaters of the Coquitlam River, and to add to the supply of water furnished by a dam it is proposed to tap a lake at an altitude of 2500 feet above the sea. Instead of laying a pipe line, the company will drive an inclined tunnel through a mountain of solid rock. The bore will be 3 by 8 feet, and 2½ miles in length. The cost of the tunnel is estimated at $350,000.

MONTREAL

The Gas Company have the same trouble to face now that electrical companies have had in the past, viz., "overloading of conductors". Owing to rapid installations of gas stoves, etc., partly helped by the coal strike, the pressure in certain localities is very poor.

Anent a fire which occurred in Montreal some months ago, caused by high tension entering the premises through a breakdown in transformer and owing to a faulty connection near main switch causing fire; we understand there is a probability of the insurance companies going to law over the matter, to hold the Lighting Company responsible. Without any comment on the points at issue, it does not seem fair that when the insurance companies are so decidedly indifferent to the appointing of an official inspector (owing chiefly to expense of such), that they should squeal when they get hit.

Poor Jack Roberts, whose body was found in the Lachine Canal recently, will be remembered by many of the old boys of the Royal Electric Company. He was one of their interior wiremen and a leading hand. After leaving their employ he acted for quite a time in a similar capacity with the Montreal Electric Company, and finally was employed by the Lachine Rapids Company on switchboard work, with whom he continued up to the date of his death.

Quite a number of contractors are of the opinion that a 9 hour day would be sufficient for their interior wiremen, and the chances are that if the wiremen put in such a request generally, it would be acceded to. Saturday afternoons, which are granted by some employers, could no doubt also be made universal.

A glance at the civic finances of Ottawa would suggest that in common prudence the municipal telephone exchange scheme should be shelved, at least for a while.

AMERICAN STREET RAILWAY ASSOCIATION.

As we go to press the twenty-first annual meeting of the American Street Railway Association is in progress at Detroit, Mich., the programme covering October 8, 9, and 10. Among the papers to be presented are the following: "Steam Turbine Engines," by E. H. Sniffen, New York; "The Adjustment of Damage Claims," by M. B. Starring; "The Transportation of Light Express and Parcel Delivery," by George W. Parker, Detroit United Railway. There is a large exhibition of street railway supplies.

THE PORTAGE LA PRAIRIE PLANT.

PORTAGE LA PRAIRIE, SEPT. 20TH, 1902.

Editor ELECTRICAL NEWS:

DEAR SIR:—I notice in your September number exception is taken to the description of the Portage Electric Company's plant. I would say in reply that the description applies to the plant as it is at the present time, and not as it was ten years ago.

Yours truly,

F. W. CLAYTON, Manager.

The Browning Engineering Company, of Cleveland, Ohio, has recently purchased from the Westinghouse Electric & Manufacturing Company a large number of railway-type crane motors, ranging in capacity from 25 to 50 horse-power.

The cross arms on the redwood poles commonly used for the electric transmission lines of the Pacific Slope are of 6x6-inch kiln dried Oregon pine, subjected to a temperature of 220 degrees Fahr. for several hours in a bath of asphaltum oil. The redwood poles are cut from young trees, not more than four from the one tree, and are counted on to last 25 to 35 years.

The Steel Storage & Elevator Construction Company has adopted electric power distribution for a large grain elevator which will be erected for the Canadian Pacific Railway at Fort William, Ontario. A recent purchase from the Westinghouse Electric & Manufacturing Company includes a direct current generator and a number of direct current motors for the operation of this elevator.

ASSESSMENT OF GAS AND ELECTRICAL COMPANIES.

Judges McDougall, McCrimmon and McGibbon gave judgment on October 4th in the appeal of the Toronto Railway Company, Consumers' Gas Company, Bell Telephone Company, Toronto Electric Light Company, and Toronto Incandescent Light Company against their assessments by the city officials. The judgment is against the companies.

The contention of the companies concerned was that under the clause in the Assessment Act of 1902 exempting rolling stock, the machinery and appliances in their buildings were not assessable. They claimed that the exemption applied to the rolling stock and all their plant and appliances save those existing on or situate upon the streets, roads, highways, lanes, and other public places of the municipality. The judgment hinged on the interpretation of sub-section 4, which reads "Save as aforesaid rolling stock, plant and appliances of companies mentioned in sub-section 2 hereof, shall not be land within the meaning of the Assessment Act and shall not be assessable." The judges point out that the construction which the companies desire to have placed on sub-section 4 would be unjust and inequitable, and contrary to the principles underlying the Assessment Act. The judgment concludes as follows:

"The conclusion of the matter then is, that the words 'plant and appliances' used in sub-section 4 must be confined to any plant and appliances located upon the streets, roadways and highways and other public places in the municipality, such words taking this limited meaning because they must be referred to the words 'rolling stock' which immediately precede them in the same sub-section, and because it was manifestly the intention of the Legislature in enacting a new section 18 of the Assessment Act, to deal only with the method of assessing so much of the property of the companies named in sub-section 2 as was situated upon the public streets of the municipality.

"This is the unanimous finding of the Board of Judges upon the construction of the Statute of 1902, but is not the formal judgment to be delivered upon the appeals pending. The formal judgment will be pronounced after hearing the evidence upon the appeals when the figures of the assessment of the property involved in the different appeals will be determined. The opinion of the judges upon the construction of the statute is issued in advance at the request of the parties."

PERSONALS.

It is understood that Mr. Alex. Storer has received the appointment of chief engineer for the King Edward Hotel, Toronto, at a salary of $1,200 per year.

T. W. Rawling, of Annapolis, N. S., has resigned his position with the Cape Breton Electric Co. to take a responsible position with the South Shore Railway Co.

Mr. R. H. Heneker has resigned as president and director of the Sherkrooke Gas & Water Company, of Sherbrooke, Que., and has been succeeded by Judge White.

Mr. Clarence Thomson has resigned the position which he has held for some years in the Patent Department at Ottawa, to join his father, Mr. Fred Thomson, in the electrical manufacturing business in Montreal.

Sylvester Potter, chief electrician for the Toronto Railway Company, a fortnight ago tendered his resignation, which was accepted by the company. Mr. Ewen Mackenzie, a brother of the president of the company, is now in charge of the department, but it is understood that the appointment is only temporary until a suitable person can be found to succeed Mr. Potter.

AUTOMATIC CAR-TYPE CIRCUIT-BREAKER.

The protection of railway motor equipments by the use of a fuse has until recently been the standard practice and recommendation of electrical manufacturing companies. The results obtained have been satisfactory only to a limited degree, as the fuse frequently fails to blow at the proper time, or to give the equipment the best protection under all conditions of service. The necessity of carrying extra fuses, as well as the inconvenience of stopping the car to replace a blown out fuse, is more or less of an objection to this method, and many of the largest street railway companies have replaced the fuse block with the automatic car circuit-breaker. This practice offers better protection to the equipment, as it reduces to a minimum the possibility of injury to the apparatus arising from the carelessness of the motorman in improperly cutting out resistance—the circuit-breaker will open automatically when the current reaches the value for which it is set.

The automatic car circuit-breaker manufactured by the Westinghouse Electric & Manufacturing Company is claimed to perform the function of the fuse block by opening an overload or short-circuit; it also replaces the platform or canopy switch, in that it provides a hand opening for the circuit. In construction the instrument is thoroughly fire-proof, of the best material and workmanship throughout, and all parts are interchangeable. Its design prevents any arcing at the current-carrying contacts, as the arc is broken on extra contacts especially provided for the purpose, and assisted by a powerful magnetic blow-out which



Automatic Car-Type Circuit-Breaker.

will open the severest short-circuit without damage. The breaker is calibrated, and can be set to open at any current within the limit of its range. The automatic opening device is said to insure absolute certainty in opening when the current reaches the predetermined value—a feature not found in any latch device, particularly if it is exposed to such weather conditions as are found in the vestibule of a street car.

NEW INDUCTION MOTOR METER.

A patent has been granted to Mr. G. L. Gowland, of Peterborough, Ont., for an induction motor meter. One object is to provide a meter having a large range and provided with a revolving armature that shall run at a speed exactly proportionate to the amount of current passing through the meter. Another object is to provide a meter which will work equally well with either inductive or non-inductive loads. This meter, Mr. Gowland remarks, should not be confounded with any meter having the usual so-called "90-degree lag," or any similar phenomena. It differs from such a meter in this respect, namely, that the flux produced at the poles of the magnets on the so-called "voltage" side of the meter is a stationary flux and is not of a revoluble nature. He obtains the rotation of the disk partly by using a so-called "voltage-magnet," the core of which is split into two members and a flat bar of copper inserted there-between. Mr. Gowland states that he has found that a flux-plate composed of thin sheets of laminae or copper disposed in planes parallel with each other and also parallel with the plate when excited by a magnet in immediate proximity to said plate produces a considerable rotative effect. The effect appears to be governed largely by the amperage rather than by the voltage of the current. With a meter of the type described, the aluminium disk need not be placed so near the magnet-poles as is required in most other meters. This fact presents the considerable practical advantage that particles of dust or dirt accumulating upon the plate do not interfere with its action, and any slight distortion of the disk is less objectionable than is the case with ordinary meters.

THE "TRITON" GASOLINE ENGINE.

The "Triton" marine gasoline engines, which have been on the market for a number of years and which have lately been greatly improved, are among the best marine gasoline engines on the market to-day. They are claimed to be absolutely reliable under all conditions, and the mechanism is so simple that it is impossible for it to get out of order. The sparking device has the fewest parts of any engine now made. This, together with the high class workmanship and the carefully selected materials which enter into the construction of these engines, and the fact that the Hamilton Model Works have confined their attention for years exclusively to the manufacture of marine gasoline engines, has no doubt been the cause of their giving such universal satisfaction.

These engines are built with either one, two, three or four cylinders, and either two or four cycle and from 1½ horse power up. The firm is prepared to take contracts for engines up to 100 horse power. The works are under the management of competent mechanics, and any person placing a contract can be assured that it will be executed promptly and in a thoroughly workmanlike manner. The testimonials that this company have received are proof alone of the universal satisfaction that their motors are giving.

The firm finds it necessary to add extensively to their premises to meet the demand for their motors. Besides adding to their floor space and the building of new offices, they have also put through a large order for a number of up-to-date machine tools.

SPARKS.

Collingwood, Ont., will ask the Lieutenant-Governor-in-Council to sanction the issuing of debentures to the extent of $10,000 for the extension and improvement of the waterworks and electric light systems.

The ratepayers of Glencoe, Ont., held a meeting recently to discuss the question of municipal lighting. The meeting was in favor of purchasing the plant of the Glencoe Electric Light Company at a fair valuation.

The Greenwood, B. C., city council have taken up the matte of building an electric railway connecting that town with Phoenix. The road will be about eight miles in length and will cost about one thousand dollars.

Mr. J. Fraser Gregory is still negotiating with the council of St. John, N. B., regarding the development of the water power at the falls. It is probable that a hydraulic engineer will be engaged to report upon the avallable power.

Campbellford, Ont., has installed a municipal electric plant at a cost of about $15,000. Indoor lights are supplied at 50 cents each per year for eight candle power lamps, and $1 for 16 candle power lamps. Needless to say, these figures will not cover the cost of operation.

The electric lighting plant at Annapolis Royal, N. S., is being extended. The corporation recently let the contract for dam, headgate, flume and power house to Robert S. Low, of Sydney, at $3,300, and that for water wheels and accessories to the Jenckes Machine Company, of Sherbrooke, Que., at $1,980. The pole line construction is being done by the town.

A correspondent of the Parry Sound Star refers to the unsatisfactory results that have been obtained in that town from the operation of the electric light plant under municipal control. When the first superintendent was in charge the monthly wage list was eighty dollars. He was subsequently replaced by another superintendent and the monthly wage list advanced to $165, but still the lights were not improved. It is claimed that the difficulty of insufficient power, could have been overcome by raising the flume to the same level as the River Improvement Company's dam, and thus have the head of water six inches higher. This would have made an immediate improvement in the lights and been quite inexpensive. Of course, it would have been only a temporary expedient, as the whole dam and flume must be raised considerably higher in order to supply sufficient power for the constantly increasing demand for electric light. The correspondent is of the opinion that the results are not complimentary to the electric light department.

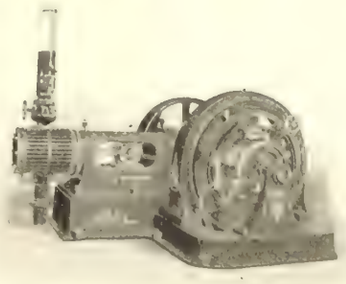
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THE NATIONAL ELECTRIC LIGHT ASSOCIATION.

Changes in the schedule of dues of the National Electric Light Association were adopted at the Cincinnati convention in May last and have resulted in a large growth of that organization. Since the Cincinnati meeting 94 new members have joined, the present membership being 266.

The Syracuse Railroad Construction Company, which is building a twenty-five mile electric railroad between Auburn and Syracuse, New York, has recently closed a contract with the Westinghouse Electric & Manufacturing Company for two 650 k. w. engine-type alternators, delivering three-phase current at 360 volts and 3,000 alternations; also for five 400 k.w. rotary converters, together with raising and lowering transformers for operating a 15,000-volt transmission line to two sub-stations. A complete switchboard is included, and in fact everything for the operation of a complete railway line. The generators are to be direct connected to two 22 and 44x48-inch cross-compound, horizontal, Corliss engines, purchased from Westinghouse, Church, Kerr & Co., and built by the Westinghouse Machine Company, of Pittsburg, Pa. The engines are to receive steam at 150 pounds, are to run at 100 r. p. m., and are rated at 1,000 h. p. each, with a maximum rating of 1,800 h. p.



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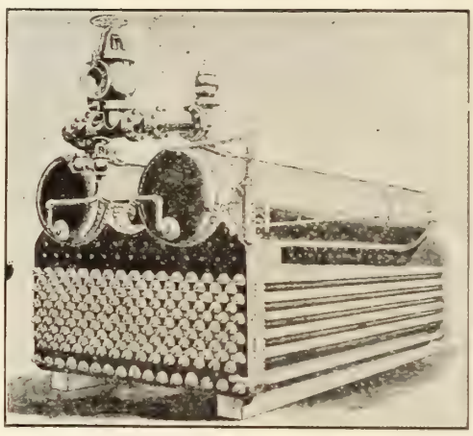
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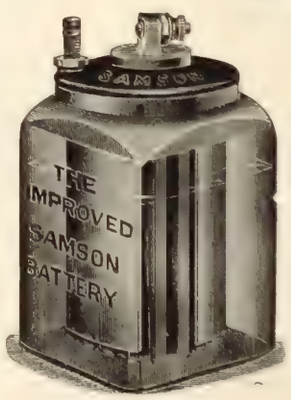
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SPARKS.

The Canadian General Electric Company are sending to their customers a binder for the bulletins regularly issued by them. It is 9 x 11 inches in size, and so arranged as to carefu ly preserve their bulletins, the latest of which is No 825 referring to belt driven generators.

The suit of the Electric Maintenance & Construction Company against the town of Orillia, Ont., for $220,000 claimed to be due in connection with the contract for the Ragged Rapids power plant, will come up before Judge Britton at Barrie on October 27. It is probable that the whole suit will be decided on the point as to whether or not the contract was broken, as Mr. Patriarche alleges, by the town.

The Electrial Trade Association of Canada, with head offices in Montreal, has been incorporated, with a capital stock of $2,000, to collect statistical and other imformation useful to the trade, to promote a cordial feeling among the members and to protect their mutual interests as far as possible. The incorporators include Messrs. R. E. T. Pringle, John Forman, George H. Olney, J. A. Burns and W. B. Shaw.

The Gee Electrical Engineering Company have remodelled and extended their office and show rooms at 11 Colborne street. They now occupy the entire building, which has been fitted up to meet the requirements of their increased business. In the store rooms are hardwood cupboards, which permit of the supplies being arranged to the best possible advantage. The offices of the manager and business staff are on the second floor.

The Westinghouse Electric & Mfg. Company have issued a complete and handsome book relating to electric locomotives for surface haulage. In view of the fact that electric locomotives are coming to be quite entensively used for haulage in industrial establishments, and on plantations, short lines of railroad, etc., the matter presented in this book is of considerable interest to our readers.

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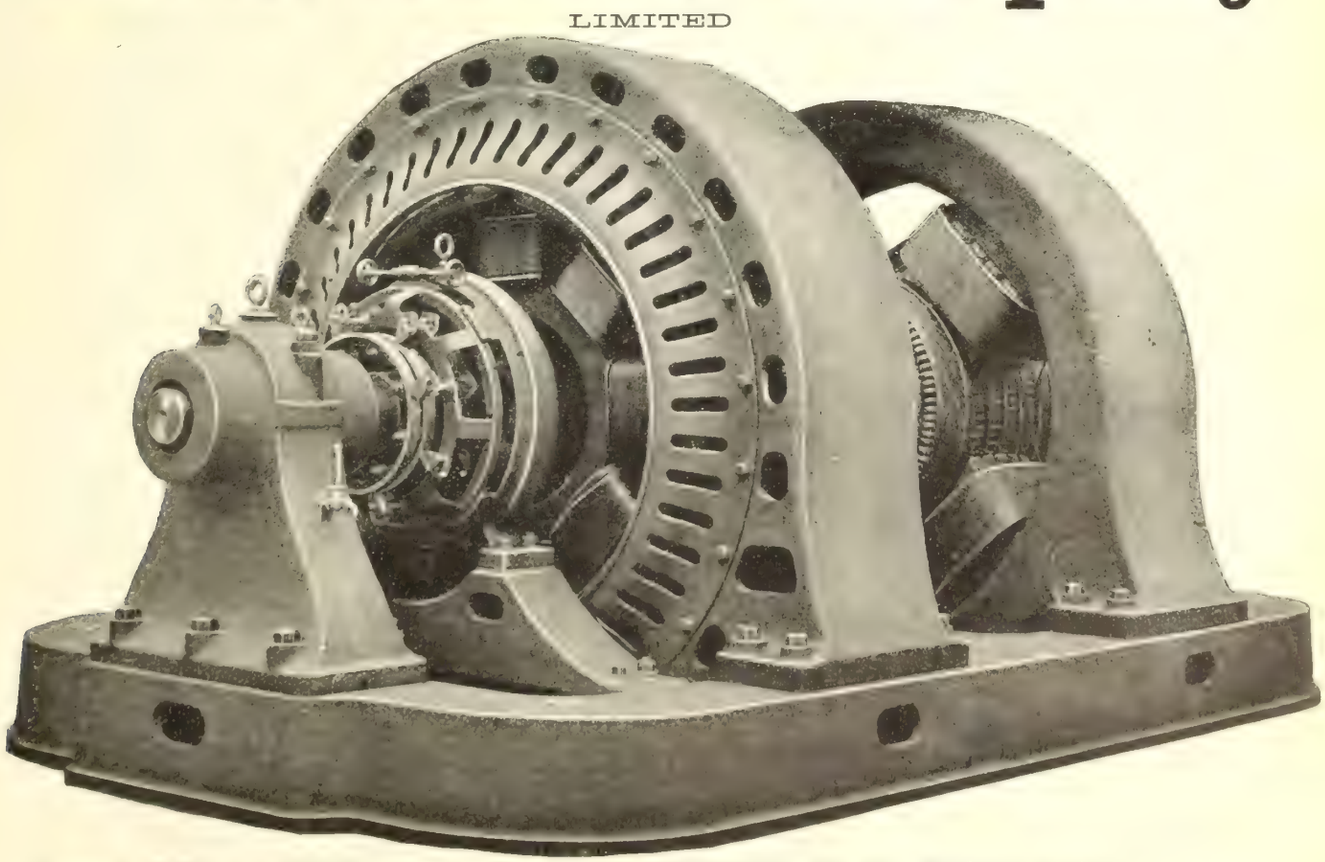
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SPARKS.

Michael Leroux, an employee of the Ottawa Electric Railway Company, was killed on September 18th by receiving a shock from a live wire at the power house.

Mr. E. S. Harrison, of the Suburban Rapid Transit Company, of Winnipeg, states that satisfactory progress is being made with the construction of the new electric road to Sturgeon Creek.

A new exchange book issued by the Bell Telephone Company for Montreal shows that since the last book was sent out 725 new telephones were installed. There are now 3,000 long distance instruments in use in that city, of which two-thirds have been added since last spring.

The Edmonton District Telephone Company, of Edmonton, N. W. T., have extended their line from Beaumont to Leduc. The rate between these two points is twenty-five cents. It is the purpose of the company to extend their line to Fort Sackatchewan next spring, for which purpose poles will be taken out this winter.

The British Columbia Electric Railway Company have just installed a 900 horse power Corliss compound condensing engine, manufactured by the Laurie Engine Company, Montreal. The engine will be belted to a Canadian General Electric generator of 1,000 lights capacity. Owing to increased business the company was forced to install the new engine and generator. No more steam power, however, will be installed, as within a year the company expect to have 1,000 horse power available at Coquitlam Lake.

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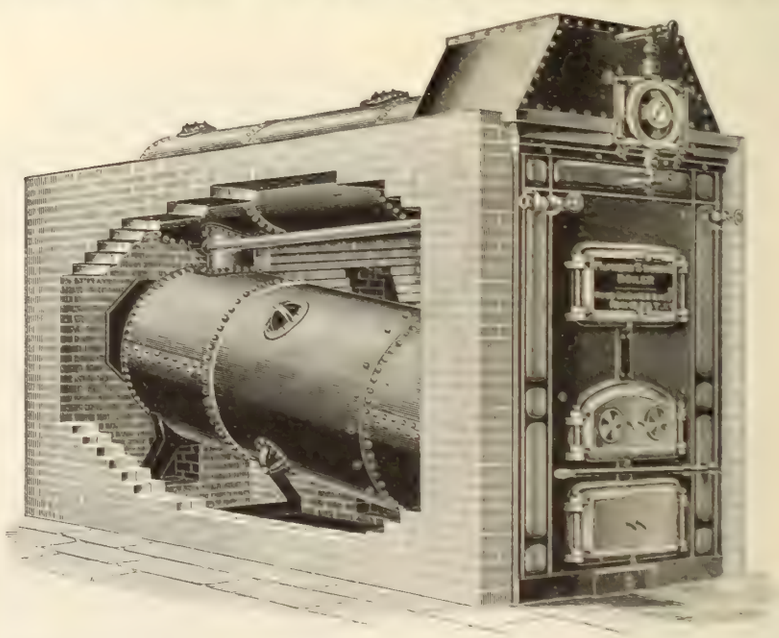
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SPARKS.

The Boiler Inspector of Montreal has reported that certain boilers at the pumping station should be replaced by new ones.

Tenders have been invited for installing an electric plant of 1,500 horse power for the corporation of Prince Albert, N.W.T.

The council of Midland, Ont., desire to assume control of the electric light plant, and have requested the company to submit the question to arbitration.

The Hinton Electric Company, of Vancouver, are installing an electric light plant at Cumberland, B. C., which will supply light for that town and for Courtenay.

The ratepayers on the first concession of Anderdon have defeated a by-law to grant a bonus of $2,500 for the Sandwich, Windsor and Amherstburg Electric Railway.

The Ottawa Electric Company has entered into an agreement to supply electric light for the village of Gatineau Point, Que. About six hundred incandescent lights will be used.

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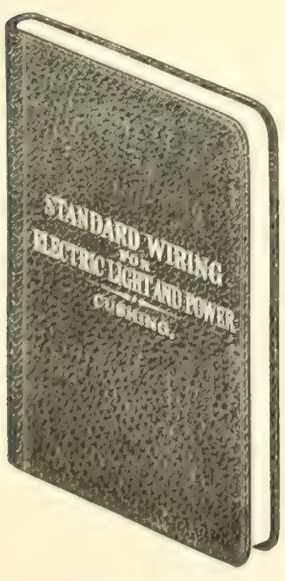
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TRADE NOTES.

Bulletins recently received from the Bullock Electric Manufacturing Company, Cincinnati, Ohio, are descriptive of their direct-current multipolar generators and motors.

We have received from the Hyatt Roller Bearing Co., of Harrison, New Jersey, a copy of their Bulletin No. 20 referring to the adaptability to heavy duty and slow moving machinery of the Hyatt roller bearings.

The Jenckes Machine Company, of Sherbrooke, Quebec, have received the contract for the turbine installation for the Booth pulp mill at Ottawa. It will include about 10,000 horse power in wheels, together with accessories.

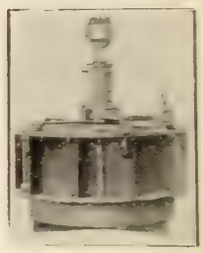
The Robb Engineering Company, of Amherst, N. S., have been awarded the contract for four large engines, comprising the entire engine equipment for electric lighting, elevators, etc., for the new King Edward Hotel, Toronto.

Mr. G. P. Eastman, late of the Eastman Machine Company, and Mr. W. F. Colwell, of the Colwell Manufacturing Company, Toronto, have entered into partnership as the Eastman-Colwell Electric Company. Premises have been secured at 128 Bay street, where they will carry in stock a full line of telephone and electrical supplies generally.

A little booklet from the Canadian General Electric Company contains many interesting points about cooking by electricity. They claim that it is a popular fallacy that the use of electric heating conveniences is expensive. As the articles requiring much current are used as a rule but a short period, the cost is said to be reasonable when compared with similar operations by other methods.

The gasoline engine business is rapidly growing, and Messrs. Goodenow & Goodwin, expert machinists, have formed a new company called the Goodenow Gasoline Engine and Motor Company, for the purpose of manufacturing gas and gasoline engines, both marine and stationary. They have already filled many orders for these engines. They also make a specialty of water motors and fans, as well as pumps for all purposes. Their works at 115 Simcoe street, Toronto, are being improved and extended.

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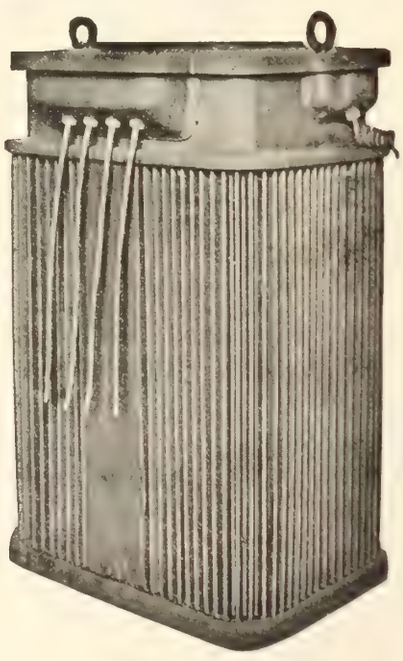
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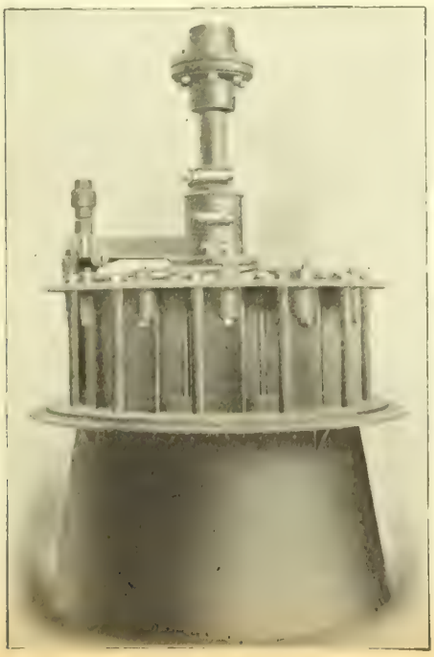
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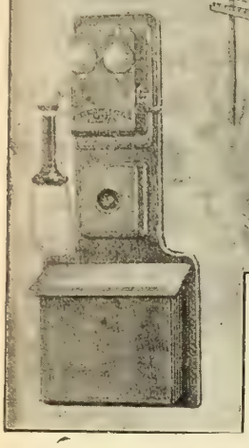
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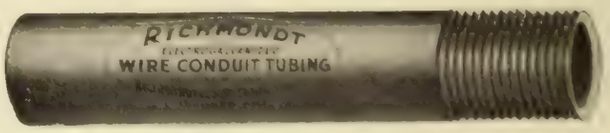
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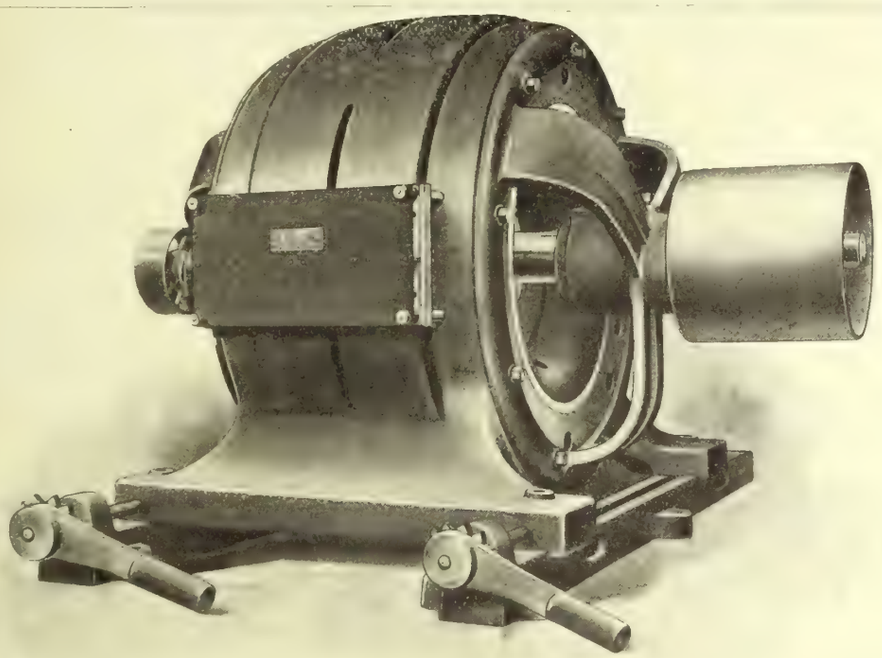
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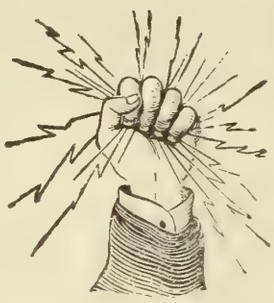
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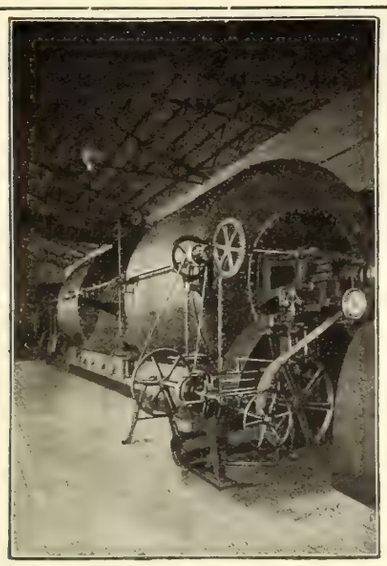
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SPARKS.

The Chicoutimi Electric Light Company, of Chicoutimi, Que., are making extensive improvements to their water power plant.

Tho Kemptville Milling Company have built a new power house at Kemptville, Ont., and are now installing the electric plant.

The International Transit Company expect to have the new electric railway at Sault Ste. Marie, Ont., in operation early in December.

It is reported that the Toronto Railway Company contemplate the erection of new buildings on the old McIntosh property, to be devoted chiefly to manufacturing purposes.

Young Bros., of Almonte, Ont., have installed a 100 light electric plant for the Almonte Knitting Company and are putting in an 80-light plant for Montford & Charbonneau, of Galetta.

It is the intention of the St. John Street Railway Company to make extensions to their road next spring. It is also proposed to install new machinery and further modernize their power house.

The city council of Montreal have decided to purchase three new boilers for the low-level waterworks pumping station. The old boilers, now condemned, have been in use for twenty-five years.

The Phœnix Electric Lighting Company, of Phœnix, B. C., has been incorporated, with a capital of $100,000. The company will obtain power from the plant of the Cascade Water & Light Company.

The Hamilton Electric Light & Cataract Power Company have the new addition to their transformer station on Victoria avenue north well under way. The addition will be used for the accommodation of the steam plant.

Mr. F. Hayes, electrician of the Chatham Gas and Light Company, is installing an electric light plant for the Beet Sugar Company, Dresden, Ont., to consist of 500 incandescent lamps and fifteen arc lights.

The waterworks system at Smith's Falls, Ont., has been expensive to operate by steam and it has been decided to adopt electricity. A 50 h. p. motor has been installed, the current for which will be obtained from the Smith's Falls Electric Company for $500 per annum.

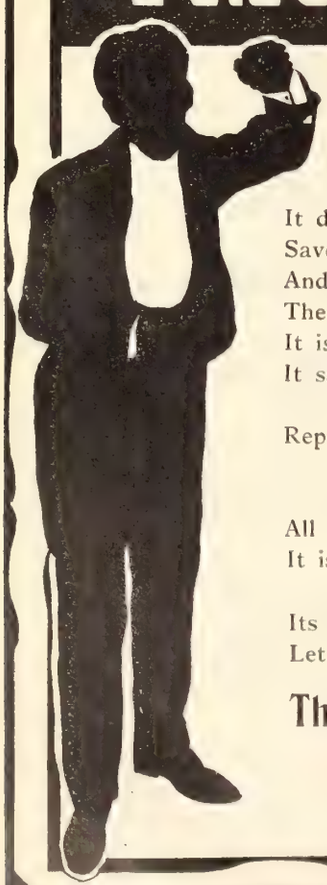
Messrs. Aylen & Duclous, acting for Edward Hanson & Company, brokers, Montreal, have issued a writ against the Hull Electric Company for $562,772, for which they claim to hold promissory notes on account of funds advanced to the Hull Electric Railway during its construction.

The annual meeting of the Quebec Railway, Light & Power Company was held in Quebec on October 9th. A satisfactory showing was made by the annual report. The directors were re-elected and subsequently elected Mr. Andrew Thomson as president and Mr. Frank Ross as vice-president.

The attendance of students at McGill University, Montreal, this year is reported to be greater than in any previous year. In the applied science department 280 students have registered: there are 93 in the first year, the largest freshman class on record. Mr. J.G. Glassco, M. Sc., has been appointed demonstrator in electrical engineering; Mr. H.B. dePencier, B.Sc., demonstrator in mining engineering; Mr. F. E. Sterns, B.Sc., demonstrator in mechanical engineering; Mr. Bigger, B. Sc., demonstrator in civil engineering.

Saturday, October 4th, marked the 12th anniversary of the beginning of the power development at Niagara Falls. The original American company has an output of 50,000 horse power, while its second power house, now nearing completion, will develop 55,000 horse power. The Niagara Falls Hydraulic, Power & Manufacturing Company has a present output of 30,000 horse power and will shortly make available over 100,000 horse power. On the Canadian side the Canadian Niagara Power Company is pushing the work for the development of 100,00 horse power, and the Ontario Power Company is now at work on its intake canal and expects to develop a similar amount.

FRICTION CLUTCH LOGIC



The Friction Clutch is superior to tight and loose pulleys for general line shaft service.

It does away with shifters.

Saves wear and tear on belts.

And saves power, as the belt movement is stopped at the line shaft.

The Dodge Split Friction Clutch is the only split clutch made.

It is the perfect clutch.

It saves money in erection as the shafting does not have to be disturbed to set in place.

Repairs are easily and cheaply made and the cost of erection and subsequent charges for repair to its working parts have been found in many cases to be one-quarter the cost of a solid clutch.

All parts are interchangeable.

It is simple, easy to erect, easy to adjust, positive in friction, and of perfect balance.

Its **ultimate** cost makes it the cheapest clutch on the market.

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The Dodge Manufacturing Co. of Toronto, Limited,

TORONTO.

AN ADVANCE STEP

For the convenience of our customers in the Eastern Provinces we have opened offices in Montreal at Room 42, Street Railway Building, Corner Craig Street and Place D'Armes.

This step has been necessitated by our increasing business and the belief that our customers' interests will receive better service and more personal attention than through the medium of a selling agency.

Mr. George C. Rough, who for the past six years has been associated with R. E. T. Pringle, Montreal, has severed connection with that company and has assumed the management of our Montreal offices.

Orders to the Montreal office will receive the personal attention of Mr. Rough, and we believe our eastern customers will receive more efficient service than in the past.

THE PACKARD ELECTRIC CO., LIMITED

R. B. HAMILTON, Managing Director.

Makers of LAMPS, TRANSFORMERS, METERS and HYLO LAMPS.

St. Catharines, Ont.

Montreal Office, George C. Rough, Manager.
42 Street Railway Building,
Corner Craig Street and Place D'Armes.

SPARKS.

The Welland Electric Light Company, of Welland, Ont., are increasing the voltage at which their incandescent lights will be operated from 50 to 104 volts.

The Deering Harvester Company, which is building extensive works at Hamilton, Ont., is reported to have contracted with the Cataract Power Company for 3,500 horse power.

The Owen Sound Electric Illuminating & Manufacturing Company, of Owen Sound, Ont., are installing a 110 light incandescent lamp plant for the McQuay Tanning Company, of that town.

A sub-station is being built at Gatineau Point, Que., for the husbanding of the electrical apparatus for lighting the municipality, the contract for which has been secured by the Ottawa Electric Company.

The article printed in last number of the ELECTRICAL NEWS referring to the Robb Engineering Company's works at Amherst, Nova Scotia, should have stated the capacity of the engines for Trinidad and Demerara Railway as 450 h.p. instead of 45 h.p.

Work has been started on the extension of the Windsor, Sandwich & Amherstburg Electric Street Railway from Ojibwa to Amherstburg. It is expected that the extension will be put in operation early next spring. The enlargement of the power house at Windsor is under way.

The Raven Lake Portland Cement Company are about to establish cement works at Raven Lake, on the Coboconk branch of the Grand Trunk Railway. They will build a power house at Elliott's Falls, on the Gull river, north of Coboconk. The head office of the company is at 16 King street west, Toronto. Mr. John Lucas is managing director.

It is reported that Mr. C. H. Flaherty, chief engineer of the Egerton Tramway Company, of Boston, recently visited Nova Scotia points in connection with a proposal of his company to build and operate an electric railway system between the towns of New Glasgow, Westville, Stellarton, Trenton and Pictou, and to control the electric lighting systems of the county from Pictou.

The report comes from Vancouver that the Vancouver Power Company have awarded to the Westinghouse Electrical & Manufacturing Company, of Pittsburg, the contract for electrical apparatus necessary to generate and deliver 9,000 horse power from Coquitlam Lake. Three generators will be installed and accommodation reserved for greatly increasing the plant.

MOONLIGHT SCHEDULE FOR DECEMBER.

Day of Month.	Light.	Extinguish.	No. of Hours
	H.M.	H.M.	H.M.
1....	P.M. 5.00	P.M. 6.30	13.30
2....	" 5.00	" 6 30	13.30
3....	" 5.00	" 6.30	13.30
4....	" 5.00	" 6.30	13.30
5....	" 8.20	" 6.30	10.10
6....	" 9.20	" 6.30	9.10
7....	" 10.20	" 6.30	8.10
8....	" 11.20	" 6.30	7.10
10....	" 0.20	" 6.30	6.10
11....	" 1.30	" 6.30	5.00
12....	" 2.30	" 6.30	4.00
13....	" 3.40	" 6.30	2.40
14....	No Light.	No Light.	
15....	"	"	
16....	A.M. 5.00	A.M. 8.15	3.15
17....	" 5.00	" 9.30	4.30
18....	" 5.00	" 10.40	5.40
19....	" 5.00	" 11.45	6.45
20....	" 5.00	" 0.45	7.45
21....	" 5.10	" 1.45	8.35
22....	" 5.10	" 2.45	9.35
23....	" 5.10	" 3.45	10.35
24....	" 5.10	" 4.45	11.35
25....	" 5.10	" 6.30	13.20
26....	" 5.10	" 6.30	13.20
27....	" 5.10	" 6.30	13.20
28....	" 5.10	" 6.30	13.20
29....	" 5.10	" 6.30	13.20
30....	" 5.10	" 6.30	13.20
31....	" 5.10	" 6.30	13.20
		Total.....	268.05

Announcement



We wish to announce that
The R. E. T. Pringle Co., Limited,
has been appointed General Agents
for the sale of Pittsburgh Transformers
in Canada.
A complete stock of our transformers
has been placed in the storerooms of
our above agents, so that orders for
these can be filled with
promptness.
Inquiries should be addressed to

The R. E. T. PRINGLE COMPANY, Limited.

105 Prince William St.
St. John, N. B.

172 Dalhousie Street
Montreal.

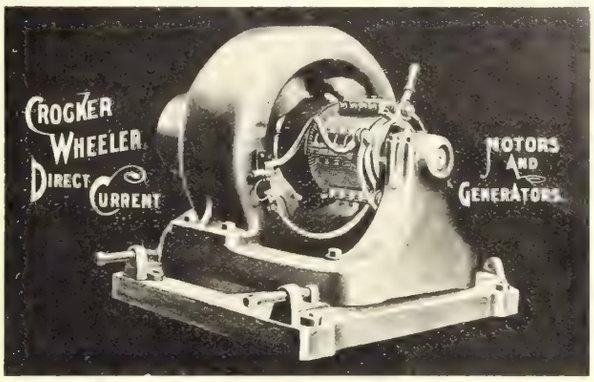
18 Toronto Street.
Toronto, Ont.

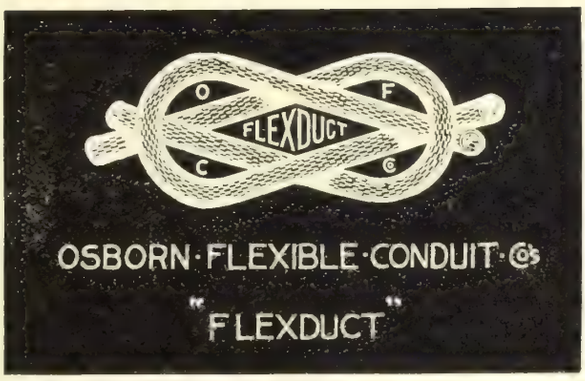
GENERAL SALES AGENTS FOR

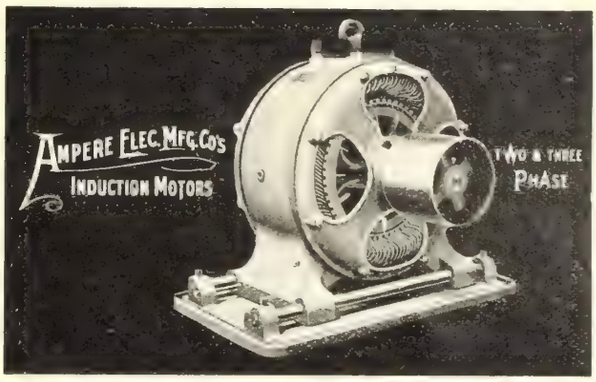
Pittsburgh Transformer Company

Pittsburgh, Pa., U. S. A.





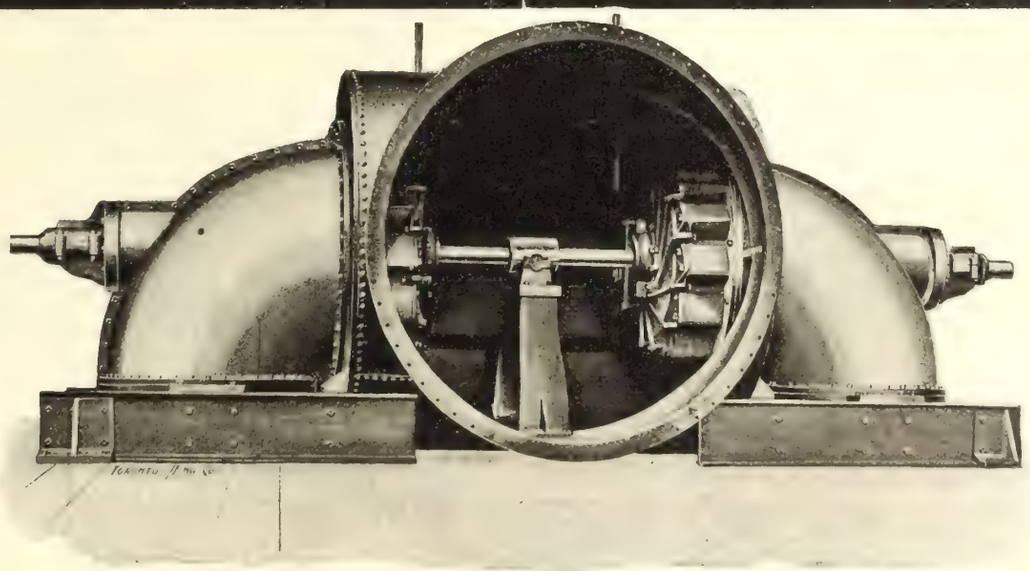




The **R. E. T. PRINGLE COMPANY,** Limited.

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MONTREAL.



The above plate shows a pair of 35 inch Crocker Turbines, in horizontal setting, outward discharge type. This arrangement can be placed in any part of the line of shafting, when circumstances permit of direct connection, power being taken off on both sides of the case if desired. We have designs for many other styles of setting. Estimates and catalogue promptly forwarded to those applying and stating conditions under which power is to be developed.

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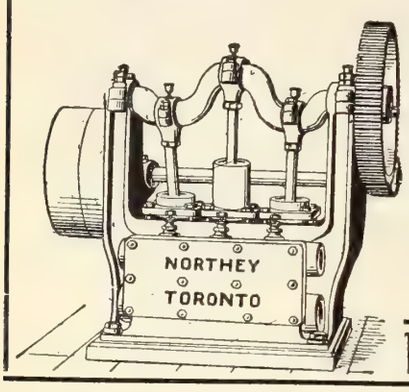
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Iron Armoured Flexible Metallic ;
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Armoured Flexible Interior Cables.

Watson Jack & Co., Montreal.

THE NORTHEY TRIPLEX POWER PUMP



This pump excels in high class materials and workmanship. A practically constant delivery is assured by the three cranks being placed 120 degrees apart. The pump can be operated conveniently by water power—by belt from engine or by electricity.

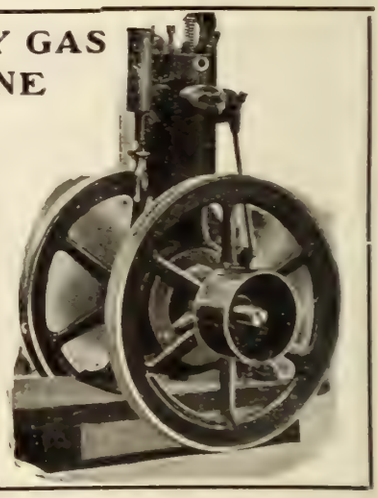
We manufacture pumps of every description—for all purposes. Our pumps are standard in Canada for excellent service.

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The Northey Gasoline Engine offers the best proposition in the market for cheap, easily handled power. The Engine runs with practically no attention—any boy can manage it—running expenses very light. Ready for work on the minute. Suitable for running independent electric light plants—pumping and elevator plants, etc. This cut illustrates the ½ H. P. size—the only vertical style built; all other sizes are horizontal.

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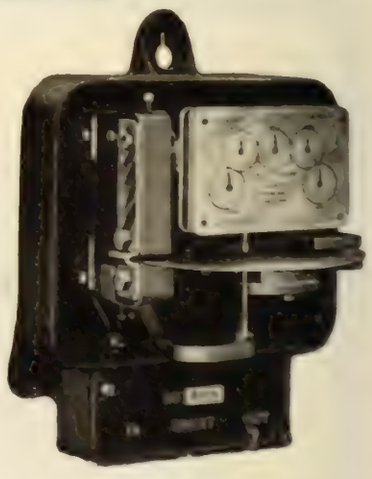
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FOR ALTERNATING CURRENTS



IN SHORT

The New Meter is of the sealed type.
Is correct on all loads from two per cent. of its capacity to fifty per cent. overload.
Internal losses are practically nothing.
Accuracy maintained.
Simplicity in design.
Firmly constructed.
Dust, insect, moisture and water proof.
Extremely light weight (10 lbs.)
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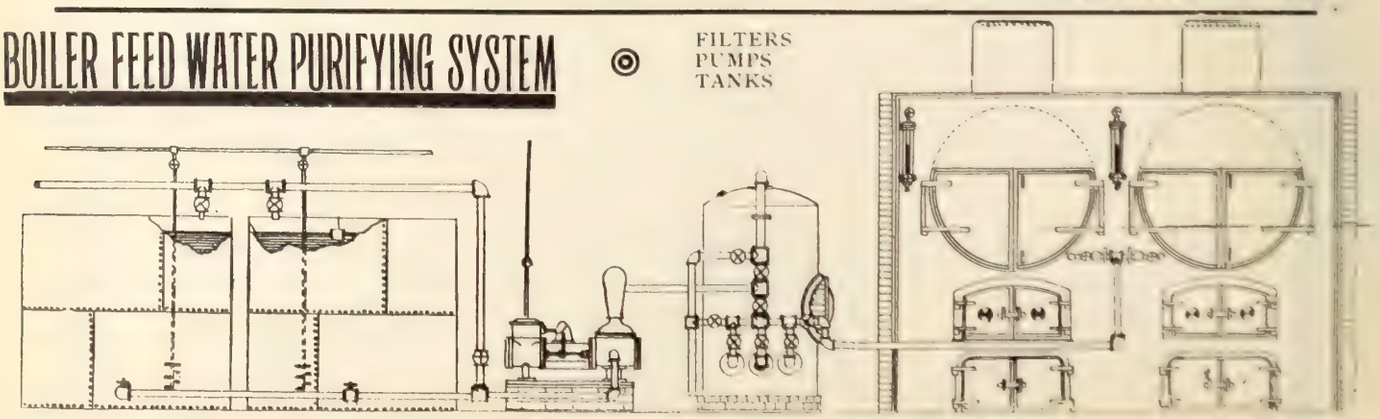


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BOILER FEED WATER PURIFYING SYSTEM

FILTERS
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CANADIAN
ELECTRICAL NEWS
AND
ENGINEERING JOURNAL

VOL. XII. NOVEMBER, 1902 No. 11.

ELECTRIC TRACTION IN SOUTH AFRICA.

During the progress of the Boer war there was constructed the Camps Bay, Cape Town and Sea Point Tramway, an electric road of nine miles in length extending from Round Church to Burnside Road, in South Africa. The work was executed by Messrs. Dick, Kerr & Company, Limited, of London, England, who have recently established a branch in Canada. In addition to the difficulties encountered under ordinary circumstances, the course of the war prevented easy shipping facilities and an adequate supply of labor, yet in spite of these drawbacks the system was completed without any serious delay. Through the kindness of the Canadian branch of Messrs. Dick, Kerr & Company, we are permitted to show several interesting illustrations pertaining to the road.



FIG. 1.—VIEW ON CAMPS BAY, CAPE TOWN AND SEA POINT ELECTRIC RAILWAY, SOUTH AFRICA.

As might be expected, steep grades are encountered, a diagram of which is shown in Fig. 2. Beginning at Round Church, Sea Point, on the south-west of Cape Town, the line commences on an easy ascent, but though gradual, it has reached at the end of the first mile an altitude of nearly 300 feet, and grades of 1 in 12 or 8·33 per cent. Continuing southward Upper Clifton is reached, and at this point a magnificent view is obtained of Camps Bay. About a mile distant and near the centre of the line stands the power house. The most southerly point of the tramway is reached at Oudekraal. Here the line diverges in a north-easterly direction, and, after encountering the heaviest grades of the system, the highest altitude is reached at Kloof Nek. At this point, some 800 feet above sea level, there is obtained one of the finest views in the Colony. As affording some indication of the difficulties of construction, it may be observed that the average grade from Kloof Nek to the terminus at Burnside Road, a distance of little more than 1¼ miles, is slightly steeper

than 1 in 12. Severe though this may be, it is exceeded in other places, where grades of 1 in 9 are encountered for short distances.

Besides making provision for carrying off the heavy rains by means of capacious drains and culverts, massive retaining walls had to be constructed, consisting of dry stonework laid in courses. In places these were of exceptional strength, measuring from 6 to 10 feet thick at the base, and from 20 to 25 feet in height, crossing the deep sluits or water-courses on the estate.

PERMANENT WAY.

The gauge of the tramway is 4 feet 8½ inches, and is thus uniform with the Cape Town tramway, over which system running powers have been obtained. The rails are of girder section, weighing 90 lbs. to the yard. They are laid on a concrete foundation, a strip of concrete 6 inches deep and 18 inches wide, composed of 5-1 Portland cement, being laid under each rail. Karri wood paving has been laid for a width of 1 foot 10 inches on each side of the track, and a 9-inch toothing course along the inner side of each rail. The rail joints are each bonded with two 6/0 S. W. G. "Neptune" rail bonds. Special cast steel points 8 feet 8 inches long, and 1 in 9 crossings, have been used.

OVERHEAD EQUIPMENT.

The side-wire system has been adopted, the trolley wire (No. "O" B.W.G.) being carried at a height of 18 feet 6 inches above the rail level. The poles are of mild steel, tapering from 7 inches at the base to 3½ inches at the top, and are furnished with ornamental base castings, finials, and brackets. The arms vary in length from 6 feet 6 inches to 15 feet according to the width of the road, the average distance of the farthest trolley wire from the centre of the track being 10 feet. Owing to the tortuous character of the route it has been found necessary to run the trolley wire partly on one side of the road and partly on the other to allow of the poles being fixed in the most suitable positions. As many of the curves are of very sharp radii, it will readily be understood that the wiring of these required con-

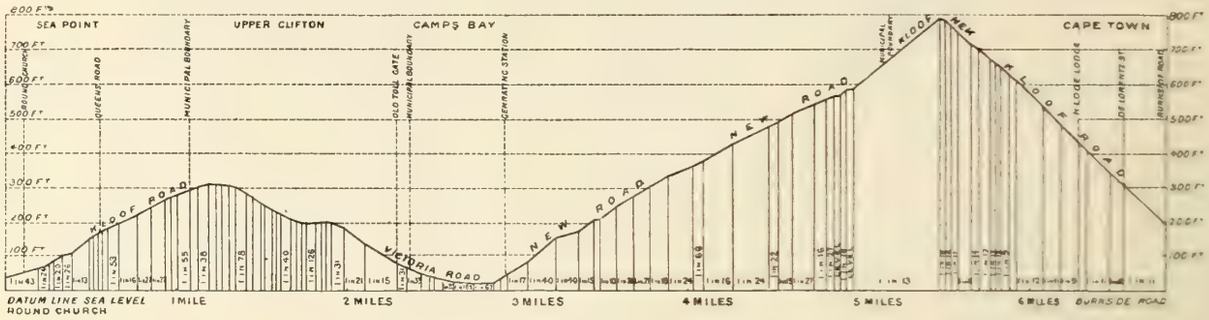


FIG. 2.—DIAGRAM OF GRADIENTS, CAMPS BAY RAILWAY.



FIG. 3.—GENERAL VIEW (CHIMNEY OF POWER STATION VISIBLE IN THE DISTANCE.)

siderable care to avoid the use of a large number of poles and the angles of the trolley wire being too acute. As will be seen from the diagram map, it is probably one of the most tortuous and heavily-graded roads equipped on the overhead system.

GENERATING STATION.

The generating station and car shed is situate near Camps Bay, almost at the southern extremity of the system. This site was the most suitable owing to its proximity to the sea, from whence water is drawn for condensing purposes. Another reason lay in the fact that a continuous supply of fresh water for boiler feed purposes is obtainable from a spring, a small stream flowing therefrom down Table Mountain.

The engine room (Fig. 4) is 94 feet by 42 feet, and consists of two floors and a condenser pit. An overhead travelling crane, arranged for hand power and capable of lifting 10 tons, runs the whole length of the engine room, and has a lift of 16 feet. The boiler house is 94 feet long by 43 feet 5 inches wide. The car shed, which is also part of the same buildings, is 136 feet long by 94 feet wide, with 8 lines of track, 4 of which have pits running their entire length.

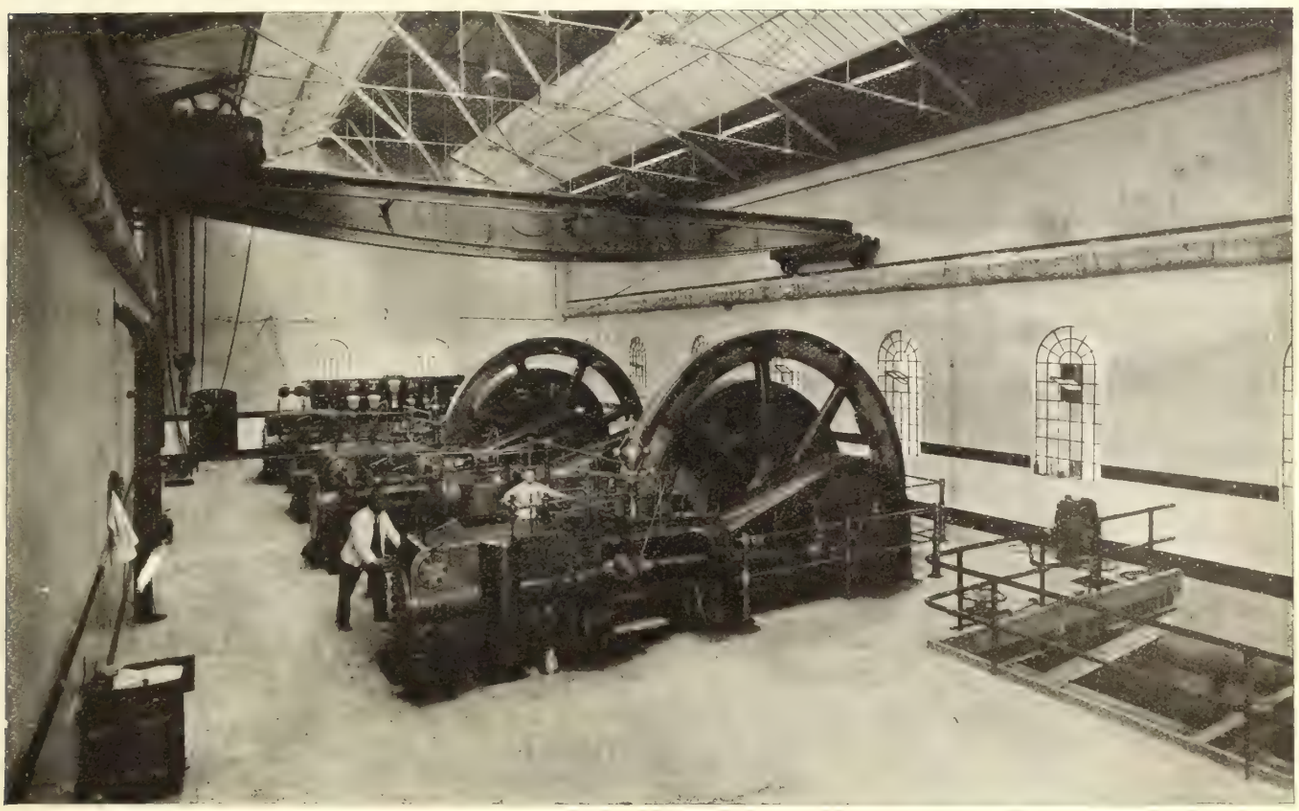


FIG. 4.—INTERIOR OF ENGINE ROOM.

The generating plant consists of two direct-coupled 400 kilowatt sets. The engines, constructed by Messrs. Yates & Thom, are of the cross-compound type, developing 720 brake horse-power with a steam pressure of 150 lbs. at the cylinders when running at 90 revolutions per minute. The main shafts are 19 inches diameter, and on these the generators and fly-wheels are keyed. The latter are 18 inches diameter and weigh about 24 tons. The cylinders are fitted with Corliss automatic valve gear.

The generators were built at the works of the English Electric Manufacturing Company, Ltd., Preston England (since aborbed by Dick, Kerr & Company), and were subjected to severe tests by the engineers of the company, who were highly satisfied with the way in which their specification had been met. The output of the machines is 400 kilowatts at 550 volts. The chief features of these generators comprise the use of a high-permeability cast-iron magnet frame, into which are cast laminated steel pole-pieces. The armature is built up on a special form of spider, in which the sections of the rim are unconnected, thus avoiding shrinkage strains. The core is built up of steel laminations, spacing laminations being inserted to form ventilating ducts for cooling the interior of the core and the windings. The armature coils are laid in open slots on the periphery and are interchangeable. The commutator is carried on its own ring, which is mounted on an extended limb of the armature spider. The commutator bars are of hard-drawn copper, and are firmly clamped by means of steel end rings. Equalizing rings are attached to the commutator and equalize any slight variations in the magnetic reluctance of the various magnetic circuits, thus checking the slightest tendency to spark.

The switchboard, shown in Fig. 5, consists of nine panels, of which three are generator panels, three feeder panels, one station panel, one lighting panel, and one leakage panel. Two of the generator panels only are in use, the other being a spare panel. Each is fitted with a positive and negative quick-breaking switch capable of carrying 1,000 amperes, a magnetic circuit breaker, and an ammeter reading from zero to 1,200 amperes. Two of the feeder panels are in use, the other being a spare. Each is fitted with an automatic circuit of the same type as those used on the generator panels, an ammeter reading up to 500 amperes, and a quick-break switch for connecting feeder to bus-bar.

The main station panel is fitted with a main ammeter reading up to 3,000 amperes, on which the total output of the station is constantly shown, and a recording

wattmeter. It is also fitted with a recording voltmeter with a working pressure of 550 volts. The leakage panel contains all the instruments necessary for testing for leakage, etc. The lighting panel is arranged for six 50-ampere double-pole circuit switches with fuses and throw-over switches.

In the condenser pit are two surface condensers with combined air and circulating pumps. These are of the Admiralty type, and are specially devised for using sea water. The sea water is supplied to the condensers by means of large cast-iron pipes, which are carried well out beyond low-water mark. To avoid the danger of sea-weed being drawn up into the condensers, the suction pipe has been intercepted on the shore by a sump built in concrete carried well down below low water level, which is easily kept clear.

In the boiler house are two water-tube boilers, each with a heating surface of 3,654 square feet and capable of evaporating 12,000 lbs. of water per hour under normal conditions. Each boiler is fitted with a dead-weight safety valve and a spring valve set to blow off at 160 lbs. pressure. The collars are fed by means of two compound non-condensing duplex feed pumps working at a pressure of 160 lbs., and capable of delivering 24,000 lbs. of water per hour against a boiler pressure of 160 lbs. Before being pumped into the boilers the feed water is passed through a fuel economizer containing 288 pipes fixed in the main flue. The chimney stack is 125 feet in height and 5 feet inside diameter at the top.

ROLLING STOCK.

Owing to climatic conditions, a variety of cars was found necessary. The cars are single-deck bogie type; part are what are known as gridiron open cars and part are of the combined type. The former have a seating capacity of sixty-five passengers, and the latter of fifty-four. The length of the car is 40 feet, width 7 feet 6 inches, and height inside 8 feet. They were built for Messrs. Dick, Kerr & Company, Limited, by the Electric Tramway Carriage Works, Preston, and shipped to Cape Town completely finished, the only work to be done before they could commence to run being to mount them on the trucks, connect the wiring and fix the trolley poles. Departing somewhat from the usual lines, the equipment of the cars comprises four motors each, of 25 brake horse-power, so that each car is capable of developing 100 brake horse-power. There is hardly any question that four motor equipments with long cars are imperative where grades are heavy, and in the case of Camps Bay the gradients are unusually severe. Not only, however, is a proper distribution of power necessary, but the question of braking and retardation is of prime importance. The brakes, therefore, on these cars have received very careful consideration, three brakes having been fitted, viz., a hand brake with a brake block on each of the eight bogie wheels, an air brake acting in conjunction with the hand brake, and an auxiliary slipper brake. In addition to these it is also possible, by throwing over the reversing switch, to convert the motors into generators, thus enabling them to act as a powerful emergency brake. The cars are operated from either end, by means of special controller, designed for four-motor equipments.

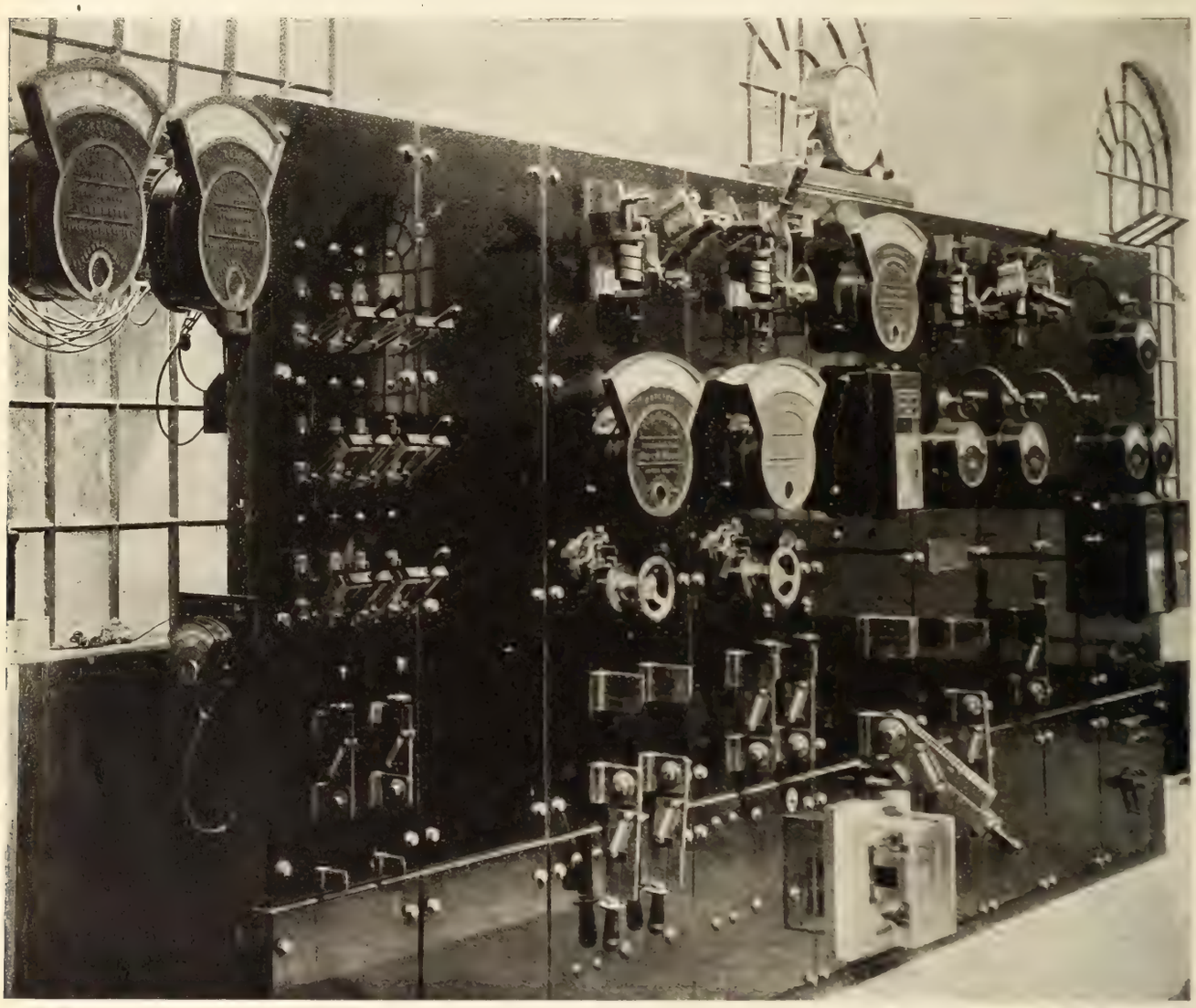
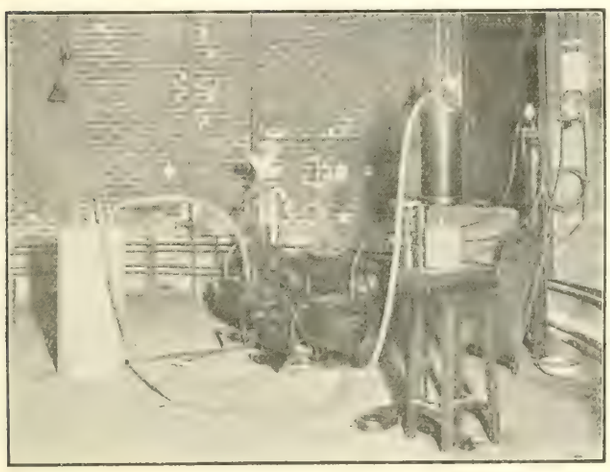


FIG. 5.—SWITCHBOARD.

THE HAMPSON LIQUID AIR PLANT AT McGILL UNIVERSITY, MONTREAL.

By Prof. John Cox.

The requisite conditions for liquefying gases have been well understood since the classical researches of Andrews on carbon dioxide in 1862. For every gas there is a "critical" temperature. Above this it cannot be liquefied by any pressure. Below it sufficient



Hampson Liquid Air Plant, McGill University.

pressure will liquefy it. Hence the failure of the older experimentees who relied on pressure alone.

A gas can be cooled in two ways. It may be allowed to expand, doing external work at the expense of its energy and falling in temperature. Or it may be boiled off from the liquid under low pressure, when the necessary latent heat of vaporiza ion is abstracted from surrounding objects, intensely cooling them. Cailletet used the former process. The gas to be liquefied was enclosed in a small tube sealed with mercury and inverted mouth downwards in a strong iron cylinder. Water was pumped into the cylinder, driving the mercury up the tube. The pressure was finally raised to 300 or 400 atmospheres by forcing a piston into the cylinder by a powerful screw. A valve was then opened, the gas was cooled by the sudden expansion below its critical point, and liquefied under the great pressure. A mist of liquid particles appeared for an instant in the tube, but no quantity of liquid was produced.

Pictet placed the gas under powerful pressure, and cooled it by allowing a more easily liquefied gas, such as carbon dioxide, or sulphur dioxide, to circulate around it in a jacket. The carbon dioxide was boiled off at low pressure, causing intense cold. The same pump then compressed it again and returned it to the jacket. By employing several stages, using each gas to cool a more refractory one, Pictet liquefied oxygen in quantity.

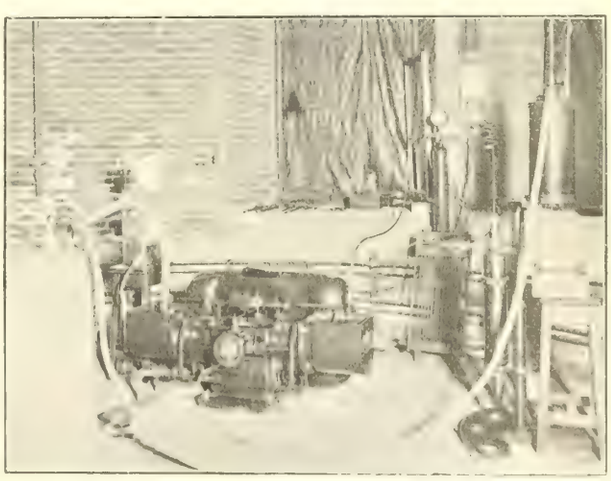
Essentially the same plan was followed by Dewar in his early experiments. But by using liquid ethylene and very powerful pumping apparatus, he obtained much larger quantities of liquid air.

In the Hampson apparatus, as in the somewhat similar machine devised by Linde, no cooling liquids are used. The process is regenerative. Air at 200 atmospheres pressure is allowed to escape at a small aperture, and is cooled on expansion. This cooled air is led back along the outside of the copper tubes through which the air is advancing to the expansion valve. The next lot of air is thus cooled before escaping, and drops to a still lower temperature on expansion. In its turn it cools the next portion of air, and when the process has gone on steadily from 6 to 10 minutes the temperature is found to have fallen below the critical point for oxygen—119 C. After this a portion of the escaping air is liquefied and collected in a vessel placed below the expansion valve, whence it may be drawn off at intervals.

The Hampson apparatus recently presented to McGill University by Sir W. C. Macdonald consists essentially of a compressor capable of supplying a stream of air at 200 atmospheres pressure, or 3,000 lbs. on the square inch, and the liquefier, seen on the extreme right of the picture.

The compressor is of the type used on torpedo boats for charging the compressed air chambers of the torpedos. It is made by the Whitehead Torpedo Company of Fiume, and is an admirable piece of designing. The compression is effected in two stages. The two pumps are placed back to back and connected to the same crank. They have a 3-inch stroke, and are driven at 375 revolutions per minute by an 11 h.p. electromotor of the Manchester type, direct-coupled on the same base. The low pressure cylinder (on the left) has a diameter of 4⅞", the high pressure (on the right) 1 5-16". The air is raised to 16 atmospheres in the low pressure cylinder, and passing over by the copper tube to the high pressure cylinder is there raised to 200 atmospheres. The thrust on the high pressure piston-rod at the end of the stroke is about 2½ tons, yet the balance is so perfect that when the compressor is running at 375 revolutions the water in the cooling tanks at the ends hardly shows a tremor. The length of the compressor is 4 ft. 6 in. over all.

The piston cups are lubricated with water taken in at a drip-cock on the suction trunk. To get rid of the



Hampson Liquid Air Plant, McGill University.

water the air is next passed into a separator (set up on the back wall). The water drops to the bottom and is blown off at intervals through a valve. The dry air passes out at the top to the bottom of the high pressure purifier—the black vertical cylinder attached to the lower part of the stand on the right. This is packed with lumps of caustic potash to remove the water vapor and the carbonic acid, which would otherwise solidify and block the pipes of the liquifier. The liquefier is the cylinder about 18 inches high seen on top of the stand. The air, now pure and dry, passes

through four sets of copper coils, interlaced, two in each direction around the axis, down to the expansion valve, regulated by the milled head at the top, and returns through the spaces between the coils to the outlet. Thence by the rubber hose it passes into the low pressure purifier. This is the galvanized iron cylinder on the left, which contains trays packed with partially slaked lime. From this it returns to the compressor together with a supplementary supply of air drawn in through a free nozzle on the low pressure purifier. The object of the latter is to save the charge of caustic potash in the high pressure purifier, and avoid the necessity of opening it too frequently.

On top of the liquefier will be seen two gauges. One of these gives the pressure of the escaping air at the outlet, so that the rate of expansion may be controlled. The other is connected to the bottom of the receiver in which the liquid air accumulates beneath the expasnion valve, while the gauge tube is connected through the hollow axis of the valve regulator with the space above the liquid air. The depth of air in the receiver is thus known. It is drawn off by the discharge valve at the bottom of the receiver into a Dewar vacuum vessel so soon as 100 c. c. have accumulated, i. e., about every 6 minutes.

The apparatus is remarkably simple and efficient. Two thermometers give the temperature of the air at entrance and exit, and so perfect is the interchange of heat, that when the temperature at the expansion valve is—180°C, the thermometers only differ by about one degree, reading 19°C and 20°C for example during one of the runs.

The apparatus was ready for trial and connections were finally made at 5:10 p.m. on Tuesday, October 21. The pressure was run up to 160 atmospheres, when the expansion valve was slightly opened. By 5:20 the gauge indicated the formation of liquid air; by 5.40 p.m. about 100 c. c. had been drawn off, and both mercury and alcohol frozen solid in it. Since then runs of three and four hours have been taken almost daily to supply liquid air for researches now in progress on the radia-active emanations from radium and thorium. Both of these were condensed at the first attempt on Wednesday, October 22nd. The rate of production is about one litre per hour, and liquid air can be obtained at any time within a quarter of an hour of starting the motor, allowing for a preliminary blow through of six or seven minutes to dry the tubes.

ELECTRIC HEATING.

The eleventh census of the United States shows that electric heating and cooking has become of practical service. Sales of electric heating and cooking apparatus, and of rheostats, amounted in 1900 to over $1,186,000. For 1901 these figures can probably be increased by twenty per cent. with a fair approximation of the truth. This is certainly a respectable showing and indicates a well established industry. Further, it is stated upon good authority that there are now in use in the United States 5,000 chafing dishes, 50,000 heating irons and 150,000 car heaters. A single hat factory in New Jersey is at present using 250 horse power for electric heating apparatus alone.

The ratepayers of Greenwood, B. C., will vote on a by-law to raise money to construct the Greenwood-Phoenix tramway.

THE AMERICAN STREET RAILWAY ASSOCIATION.

The twenty-first annual meeting of the American Street Railway Association was held in Detroit on October 8, 9 and 10. From every point of view it was very successful; the total number of persons registering was 1,779. The Association has grown to such a size and the need of a large exhibit hall has become so imperative that there are but few cities in the United States which are suitable meeting places. For this reason the committee appointed to select a meeting place for the convention of 1903 was unable to report a decision.

A lengthy address was delivered by President Vreeland, in which he pointed out that eleven years ago there were only 1,800 miles of electric road in the United States, while to-day there are upwards of 24,000 miles, representing an investment, approximately, of $2,000,000,000. He referred to the prospect that the direct application of alternating current to railway work would remove some of the inconveniences which now exist in the present system. G. W. Parker, of the Detroit United Railway, read an interesting paper on "The Transportation of Light Express and Parcel Delivery." He explained in succession the various details of the express system organized by the Detroit United Company.

Perhaps the most interesting paper of the convention was presented by E. H. Sniffin, entitled "The Steam Turbine; its Commercial Aspect." Mr. Sniffin gave information in detail of turbine plants now in operation. In units as small as 400 k. w., a result may be obtained of 14.47 pounds of steam per brake horse power per hour, corresponding to 13¾ pounds per indicated horse power. In a recent instance a result of 11.7 pounds of steam per electrical horse-power per hour was guaranteed on a turbine of 750 k. w. capacity, corresponding to about 10.17 pounds per indicated horse power, which is perhaps within the ability of but few engines of any size or type that have ever been built. The space required for the steam turbine was a consideration in its favor. The quantity of foundation material required also made a favorable comparison. The only foundation needed for the turbine is that necessary to hold its weight. In a showing of the comparative engine-room building cost, the basis assumed was fifteen cents per cubic foot of space inside of walls. The building cost of the turbine is about one-half of what is required for the horizontal or vertical engine. As to the cost of the turbo-generator itself, Mr. Sniffin stated that its price is reasonable; indeed, where the comparison is fair the turbine will require the lesser first investment. The larger field for the turbine begins about where the high speed engine leaves off. The advantages of the turbine in parallel operation were brought out, and also in the use of superheated steam. The turbine may be used unreservedly with superheat of any feasible temperature.

A number of other papers bearing directly upon electric railway work were submitted. J. C. Hutchins, president Detroit United Railway, Detroit, was elected president; W. Caryl Ely, president International Railway Company, Buffalo, first vice-president; W. Kelsey Schoeff, president Cincinnati Traction Company, second vice-president; P.S. Arkwright, president Georgia Railway & Light Company, Atlanta, third vice-president; T. C. Pennington, treasurer Chicago City Railway, secretary and treasurer.

The exhibit of electrical aparatus at the convention was most complete and attractive, embracing practically everything within the realm of street railway operation.

Canadian companies were represented at the convention by the following: E. H. Heating, M. Power, D. Sutherland, G. H. Sweetlove, W. H. Moore, W. H. Nix, R.E. Brown, D.J. Kearns, H. Cowan, Toronto Street Railway Company; E.D. McCormack, A. B. Lambe, Canadian General Electric Co., Toronto; E. B. Biggar, A. W. Smith, B. B. Jenkins, Toronto; T. W. Casey, W. G. Ross, D. Robertson, Montreal Street Railway Company; W. Phillips, Winnipeg Street Railway Company, Winnipeg, Man.; William Pulling, Windsor, Sandwich & Amherstburg Railway, Windsor, Ont.; T. Ahearn and Warren Y. Soper, Ottawa Electric Railway Company; C.K. Green, T.B. Griffith, D. N. Miller, Hamilton Electric Light & Cataract Power Company, Hamilton; C. E. A. Carr, H. Break, R. H. Welborn, E. R. Carrington, London Street Railway Company.

The City Council of Toronto have accepted the tender of the Canadian General Electric Company for electric generators for city hall, and that of the Waterous Company, Brantford, for engine.

SCHOOL OF PRACTICAL SCIENCE: CHEMISTRY AND MINING BUILDING.

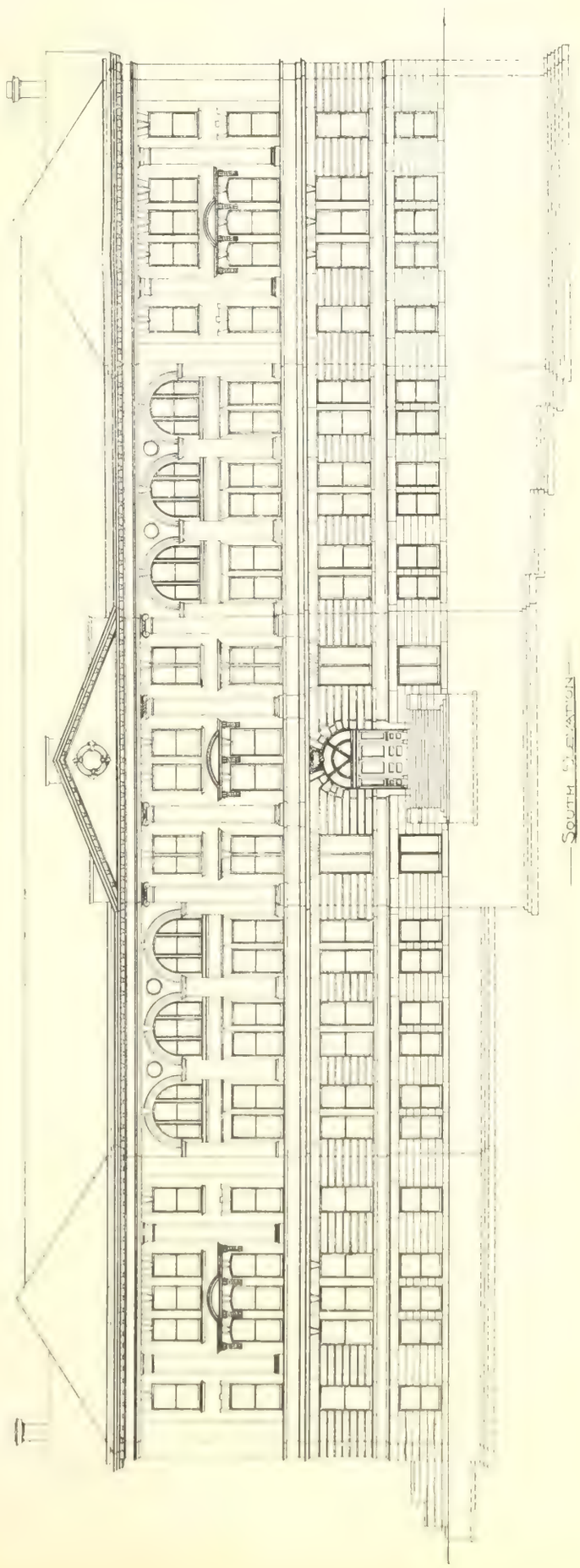
On concrete foundation walls now in place at the head of McCaul Street, Toronto, the Ontario government are proceeding to erect the brown stone and brick building shown in front elevation, in the annexed plate, as it will appear from College street. The plan will cover about 262 feet from east to west, with two wings, of which the western will have a depth of about 130 feet and the eastern 102 feet. It will be placed about 30 feet back from the street line. This building is for the accommodation of the Departments of Chemistry and Mining of the School of Practical Science. Students in all departments of the school will thus attend this building for all lectures and laboratory work in Chemistry and Metallurgy, as well as the students in Chemistry and in Mining Engineering. The accommodation provided in this building will also be made to suffice for the classes in Mineralogy and Geology in the Faculty of Arts.

In addition to a sab-basement for pipes, there will be four floors available for purposes of instruction and research. A main corridor runs east and west on each floor, from which access is obtained to rooms on each side as well as to the two wings of the building. Ventilating fans will be provided in the basement which will deliver fresh air, screened from dust, and warmed if necessary by steam coils to 70 degrees Fahrenheit, to the different rooms; but in winter the main heating will be done by radiators distributed through the building and used as required. The air will also be exhausted by fans in the attic when it is desired to have better ventilation. In this manner the ventilation and heating in each part of the building are separately under control.

The steam coils and radiators while in use will be supplied wholly or partly from the exhaust steam of an engine driving a D.C. dynamo, from which the ventilating fan motors will be supplied, as well as the current for lighting the new and the old building. At other times the usual city service will be used.

The museums for minerals and geological specimens will occupy an area about 50x80 feet in the east wing. In addition to lecture theatres, chemical, mineralogical and assay laboratories, metallurgical furnaces, and work rooms for fossils and minerals, lithology and crystallography, there will be a number of rooms for special purposes, such as calorimetry, gas analysis, toxicology, photography, electrolytic assay, fire-proof and constant temperature rooms. Of special interest to the readers of this paper are a series of rooms in the basement, marked on the plan: Junior Electro-Chemical Laboratory, Senior Electro-Chemical Laboratory, Electric Furnaces, Commercial Electro-Chemical Cells, and Storage Battery, respectively, with balance room and store room adjoining.

Next spring the Milling Building of one storey, about 75 feet square, will be begun on ground at present occupied by the old Wycliffe College building, immediately north of the centre of the new building. The Milling Building will be equipped with such appliances as are usual in modern milling laboratories, such as stamp mills, vanners, rolls, separators, leaching plant, etc.



SOUTH ELEVATION.

SCHOOL OF PRACTICAL SCIENCE, TORONTO: CHEMISTRY AND MINING BUILDING.

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EDITOR'S ANNOUNCEMENTS.

Correspondence is invited upon all topics coming legitimately within the scope of this journal.

The "Canadian Electrical News" has been appointed the official paper of the Canadian Electrical Association.

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European Peculiarities.

FROM our esteemed contemporary, the Electrical Review, we extract several interesting particulars regarding a hydraulic installation recently completed at Bienne, Switzerland, for the supplying of electric light and power to the surrounding district. The first is that the wheels, arranged in groups of four, and driving through direct connection to a 1100 k.w. alternator, are of the vertical style, and so necessarily is the generator. The practice over here would be to arrange the equipment horizontally, as the head is but 30 feet or less. Another peculiarity is that of the arrangement of the exciters, of which there is one for each alternator, direct (?) driven through two sets of bevel gears with their intermediate shafting, these in turn being excited from another direct current machine of comparatively small capacity, direct driven from a separate wheel. The reason given for this most extraordinary combination is the old story of good voltage regulation, changes in load on the alternators not disturbing the pressure as much as if the main exciters were self-exciting. Personally we would much dislike to have to be responsible for the continuity of a service supplied through such a train of operations as this arrangement involves, compared with the simplicity of one direct-driven, self-excited, compound-wound exciter capable of supplying the whole, or a large part, of the station, which is current practice here to-day. Another point on which the system differs materially from our methods is that all the lighting, which forms no inconsiderable part of the total load, being 950 k.w. out of a total of 2100, is single phase and connected all to one phase. On this side of the water the man who knowingly put over 60 per cent. of his load onto one phase, when it was practicable to make an almost perfect distribution, would be looked upon with curiosity and awe.

Starting Synchronous Motors.

FOLLOWING up our remarks in last issue on this subject: If the normal voltage of the line were thrown onto the motor when at rest it would result in a current flow of two to three times the normal load of the machine, or possibly more, depending on the design of the particular plant in question, with its attendant voltage disturbance and fuse blowing all over the system, and to obviate these difficulties and as an alternative to the starting motor, a compensator is installed. This device is a species of transformer, equipped with a double-throw switch which in one position connects the motor to a voltage ranging from 30 to 70 per cent. of normal, depending on the starting effort required, while in the other it disconnects the compensator windings and applies the line potential direct to the motor. When the synchronous motor can be installed so that all or nearly all of the load can be disconnected from it until the machine is running, the starting torque required being comparatively small, the compensator method will prove the most desirable system for starting, eliminating as it does all moving apparatus other than the synchronous motor itself, and also being somewhat more simple to handle, as, the motor being connected to the line from the first, there is no necessity for phasing devices. As noted above, this system is suitable only in those situations where but small starting effort is required, otherwise the

current drawn from the line becomes too large, in which event a starting motor will prove the more desirable. It should be noted in this connection that the induced voltage in the field of the motor may in some cases be so high as to render it inadvisable to adopt this method, and further, that it is not applicable at all to machines of the inductor type, which have no starting torque, but which must be first brought up to synchronism by a starting motor.

Westinghouse Single Phase Railway

At a meeting of the American Institute of Electrical Engineers, held in New York City on the 26th of September, Mr. B. C. Lamme presented a paper covering the outline of the new system of single phase railway apparatus for which the Westinghouse Company has just made its initial contract, and to which reference was made in our last number. The space available prevents our touching on but a few of the more interesting points. The frequency of the system is 16⅔ cycles, which was chosen because it made the construction of the generators more simple than would the higher periodicities, this point being especially valuable in this plant where a pressure of 15,000 volts is generated direct in the machines, the highest yet attempted. Further, it is interesting to note that alternative machines were quoted upon, though not adopted, which were to be wound for 20,000 volts. The low periodicity has the further advantage of much lessening the drop in the rails, which naturally is much increased over that in the direct current system, but on the other hand it leads to difficulty in the flickering of the incandescent lights, which was finally overcome by the use of a thick filament low voltage lamp, connected several in series. The motors will be series wound for 220 volts, and equipped with a commutator similarly to the standard direct current machine, the statement being made that the enormous sparking, which has hitherto stopped all efforts to develop a motor of this class, has been overcome. This type of machine possesses characteristics not greatly different from those of the standard direct current motor of to-day, that is, it has the power of automatically varying its field strength, and therefore its speed, with changes of voltage and load, the most valuable characteristic of the series wound direct current machine. The various voltages applied to the motors to obtain different speeds are produced by an induction regulator, similar to those used in central stations, which is connected to the 320 volt tap of a 1000 volt compensator or auto-transformer wired between the trolley and the rails. This regulator has a maximum boosting or choking range of 100 volts, which subtracted from the 320 volts of the compensator gives about 200 volts, the minimum found necessary for smooth starting, added to it producing some 420 volts—the maximum required for two motors in series. The great advantage of this method of control, compared with direct current working, is that there are no moving contacts and no circuits to be opened except when the current is completely interrupted for stopping. The four motor fields are permanently connected in two parallels of two in series each, the armatures also being similarly wired, this allowing the use of but one reversing switch.

The starting and slow speed efficiencies of the car will be much better than those of the standard direct current equipments, as no rheostats are needed, the voltage being varied as before described by an induction regulator. The line efficiency will also be improved, as the voltage is 1000 as against the 500 obtaining in the other system. Also there will be a further gain in the substations, where the losses in the rotaries or motor generator sets will be eliminated. Against these must be put a somewhat lower full speed efficiency and a greater rail drop. On the whole the system is guaranteed to have a combined efficiency equal to or better than a direct current plant using rotary converters, the average power factor being estimated at 86 per cent.

Is Your Wiring Safe ?

There have been a great many fires lately in Canadian cities whose origin has never been satisfactorily determined and which have consequently been blamed on that force, to the layman so mysterious and uncontrollable, which is called electricity. The popular verdict may be right, or it may be wrong, but the fact remains that a large proportion of the electrical installations in this country, more especially the older ones, are in a state so dangerous that it is simply amazing. As instances may be cited a warehouse which, devoid of attendants 90 per cent. of the week, and filled with cotton and woollen millstock, was wired without an entrance switch and equipped with the ordinary link fuses, absolutely open. The chances of a melting fuse igniting the bales not over eight feet away and directly below them were so great as to amount almost to a certainty, in fact the woodwork bears evidence of one fire which has already occurred and which was due, so we are informed, to electrical causes. Another case is a church in which the wiring, ramifying all over and through the building, mostly wood, and minus any attempt at bushing either with porcelain or even rubber at the many points where it passes through walls and floors, is supported by wooden cleats in its many wanderings past gas, water and furnace pipes of all descriptions. Investigation would probably show many such installations as these; is it any wonder that fires occur in them? Rather is it not a source of surprise that so few fires occur, especially when we consider the many chances that exist for line crosses, transformer breakdowns and lightning discharges bringing into the building potentials which are not only much greater than can be controlled by the insulation of the circuits, but which in addition are dangerous to life. A stitch in time saves nine ; if you are a consumer why not spend the comparatively small amount necessary to put your wiring in good shape, at any rate have it periodically inspected ; if you are a producer look carefully to your own lines, especially those in the station itself, in addition urging upon your customers the necessity of keeping careful track of the electrical material, both new and old, both machinery and wiring, which they may from time to time have upon their premises. If these precautions are taken, the public will gradually become less skeptical of electricity as a fire hazard. There is no reasonable man who does not acknowledge that electrical illumination and electrical power, compared for instance with oil and gas, are not only the most artistic and convenient, but far and away the safest, it therefore behooves us all to see that as far as in us lies, due precautions are taken that the enemy be not given cause to blaspheme.

QUESTIONS AND ANSWERS

A. H. Moore, Sunderland, Ont. : Kindly answer in your November edition, how many gallons of water per hour should it take to run a simple high speed engine running 250 16 c. p. electric lights.

Ans.—Assuming that each lamp consumes 60 watts, the total power delivered to the load will be 15 k. w. or 20 h. p. Allowing for 10 per cent. loss each in the line, dynamo, belting and engine, the indicated horse power of the latter will be almost exactly 30 h. p. An ordinary high-speed engine of this size, non-condensing, will consume about 40 pounds or 4 gallons of water per horse power hour, which would make the total consumption for the load you specify, assuming that no extraordinary conditions are present, 120 gallons per hour.

"Electrician": Why is the air gap on an induction motor made so small, especially when compared with that of a synchronous motor?

Ans.—The depth of the air gap determines the resistance of the magnetic circuit, and thus the magnetizing current required, and as this magnetizing current in turn largely determines the total current required by the motor to produce a given horse power, it will be seen that the smaller the air gap, other things being equal, the less the current input for a given power output. It is, of course, highly desirable to keep this current down to the smallest amount possible, as it not only affects the size and consequently the cost of the motor itself, but also those of the transformers, line and generators. In a synchronous machine, the magnetization is produced by direct current from an exciter, and thus does not affect the alternating current input so materially; the air gap is then made larger so that there may be a greater latitude allowed for wear in the bearings, variations in the size of the armature and the bore of the field, etc.; without encountering difficulties by the armature rubbing against the field.

W.J. Moore, Meaford, Ont.: How would I recharge dry cells? I have a direct current 110 volts 1½ k. w. machine and also an arc machine giving 6 amperes, and voltage various with number of arc lamps burning (series arc.) Could I recharge cells from this source?

Ans.— The most usual way of charging cells is to put them across a 110 volt machine, all in series, and also put in series with them a sufficient number of incandescent lamps to pass the charging current required. This can be ascertained, for the ordinary types of batteries, by adjusting the circuit until the voltage is about 2 volts across each cell. They could also be charged from the arc circuit by connecting them into it all in series and putting in parallel with them a resistance adjusted so that you get about 2 volts across each cell, though it is scarcely desirable to do work of this kind in connection with a high potential circuit.

An Eastern lighting company wish to know what they can do to run a direct current motor of 220 volts from a 500 volts direct circuit. They require both voltages at same time.

Ans.—The only possible way is to put a rheostat in series with the motor which will have a resistance sufficient to cut the voltage approximately in half, and which will have a current capacity equal to that of the motor. This method will be fairly satisfactory if the load on the motor does not vary, but if it does the speed will keep constantly changing, and the motor may be damaged, particulary the fields, which may get extremely hot. It should be noted that this is a very inefficient method of working, as just as much energy is wasted in the rheostat as is utilized in the motor.

"R.S." writes: Would you please explain to me reason for the statements so often made that it is not profitable to run incandescent lamps more than a certain length of time, why not leave them burning till they actually give way. Does the consumption of energy or current increase as the lamp grows older?

Ans. — If it were possible to manufacture a lamp which until it actually broke gave the same candle power and took the same current as it did when new, the pratice of renewing lamps after they got a certain age, instead of leaving them till they burnt out, would be entirely wrong, but the point is that the ordinary commercial lamp, to a greater or less extent, depending on whether it was originally of a poor or good quality, deteriorates materially in its light giving power after burning a certain number of hours, this deterioration not being accompanied by a corresponding decrease in the energy which it consumes; for instance a 16 c.p. lamp may be found to be giving but 10 c.p., which is only about 63 of its original rating, and still be consumming 90 to 95% of the current which it did when first put on the circuit. Obviously, if 10 c.p. is enough light, you should put on a 10 c.p. lamp, which will consume but about 70% of the energy taken by the old 16 c.p. The energy consumed by incandescent lamps does not increase as the lamps get older, tending rather to slightly decrease, though not to any marked extent.

"Student": What is meant by the effective weight of the lever of a safety valve? What is the rule for finding it?

Ans.—By effective weight is meant the actual weight with which the lever, pivoted at the heavy end, bears down upon a point placed the same distance from the pivot as the centre of the valve is from the fulcrum, in other words the weight with which the lever alone tends to bear bown upon the valve, when placed ready for service. The rule for finding this weight is: Balance the lever, and measure the distance from the point where it balances to the fulcrum, multiply this by the weight of the lever, and divide by the distance from centre of the valve to the fulcrum. The actual total weight on the safety valve is that of the weight multiplied by the leverage it has, plus the weight of the valve itself, together with the effective weight of the lever.

"Reader": What is the maximum permissible overload of the ordinary direct connected unit?

Ans.—The maximum output or overload is usually determined by the engine, which can seldom keep the machine up to the requisite speed under much more than 25 or 30% overload, though this is really determined by the steam pressure. As far as the dynamo is concerned you will find that machines of standard make will carry 50% more than their normal capacity for say three or four hours without heating to an injurious degree, a momentary output of twice their normal without sparking beyond a reasonable amount.

ELECTRICAL ENGINEERING AT THE SCHOOL OF PRACTICAL SCIENCE.

The students in the Department of Mechanical and Electrical Engineering at the School of Practical Science, Toronto, this year number 160, of whom eighty are registered in the first year, out of a total of 142 students in that class. The total number of students now enrolled in all Departments of the School is 340, which corresponds to an increase of about fifty per cent. as compared with two years ago. The same proportion of increase is found in the students in the above Department.

Owing to this large gain in numbers the stuff has been increased this year by the appointment of H. W. Price, B.A.Sc., as Demonstrator in electrical engineering. Mr. M. V. Sauer is this year Fellow in electrical engineering.

Considerable additions are being made to the equipment, particularly for the study of the alternating current. Among these may be mentioned a Wagner single-phase motor, a General Electric 7½ h. p. experimental polyphase induction motor, which can by substitution of a revolving field be used also as a polyphase dynamo, and a constant current transformer for series arc lighting, made by the General Electric Company, regulating at 6.6 amperes. We might also mention a large Braun vacuum tube with translucent cross-sectioned screen, which by the motion of the projection on it of a deflected cathode ray indicates the instantaneous values of current and voltage. A McFarlan-Moore vacuum vibrator apparatus for the illumination of vacuum tubes, a Simon's singing arc lamp and other minor apparatus, as well as a considerable addition to the list of Weston and Thomson instruments, have been purchased.

There is no immediate likelihood of change in the course of study, though a sub-division into two courses, namely, mechanical engineering, and electrical engineering, will probably before long become desirable. It would appear also that in order to gain the fullest possible advantage from the new building of the School of Practical Science now being erected for Chemistry and Mining, it may be wise to increase somewhat the latitude with regard to options. A description of this building appears elsewhere in this issue.

HOT WATER HEATING FROM A CENTRAL STATION.*

BY F. H. McKNIGHT.

Owners of electric light plants have long desired to increase the earning capacities of their properties without appreciable additional expense. This has lead to an investigation of the utilization of exhaust steam as a means of heating buildings. Wherever this business has been added to an electric light plant it has proven its salvation, especially where competition has been keen and profits small.

The purpose of this paper is to give a general idea of the equipment and operation of such an enterprise.

Details of Construction.—Pumps and condensers, or heaters, an expansion tank and a catch-all constitute the equipment of the station. Large duplex pumps are used to circulate the water about the system. They are operated at a low pressure during moderate weather, but in extreme cold weather the pressure is increased.

An open tank of sufficient capacity is placed at an elevated position, and used as an expansion tank for the system. Any good condenser or open heater into which the exhaust steam from the engines is turned can be used. The condensation formed is conducted back to the boiler by means of a small automatic pump, furnishing a quantity of heated water free from impurities, the oil having been extracted by means of the catch-all. The water for the heating system is pumped under pressure into the condensers or heaters, and becomes heated, passing out of the condensers or heaters and continuing its travel about the circuit. The condenser should be of ample size to heat sufficient water to care for the amount of radiation installed. A continuous and uninterrupted service during the heating season is assured by having all station equipment in duplicate.

The Mains.—Upon leaving the station, from eight to twelve-inch pipe is used, this depending upon the capacity of the system; the size of same is reduced at intervals until the end of the line is reached. The two pipe system has many advantages, in my opinion, over a single-pipe system; one pipe being used for the supply, and the other for the return. With this arrangement water is brought directly into each building from the heating apparatus, not having passed through any other building.

The insulation of the mains is a matter which necessitates much care and attention. The material which has been found to be the most efficient and inexpensive consists of hemlock boxes, built with double air-tight compartments in which the mains are laid; the space remaining about the pipes being well filled with process shavings or mineral wool. The outside of the boxing is protected by a prepared building paper.

Where this kind of insulation has been used the loss of heat on the line amounts to not more than 15 to 20 degrees; that is to say, when water is sent out at 180 degrees, it will return to the plant at 160 degrees. Thus when this water is raised from 160 degrees to 180 degrees, it is ready to send out again. Care should also be taken in anchoring the mains and providing for expansion.

Cost of Operation.—The expense of operating the heating plant under ordinary conditions is not great, the principal expense being in the amount of live steam used to operate the circulating pumps, which at no time is any great amount, the total for the entire heating season being a comparatively small item. No extra labor is needed at the plant, since what little attention the heating plant may require can be given by the same force of men heretofore employed at the electric light plant.

In order to fully realize upon the investment at the earliest possible time, it is most desirable to secure the services of one who is thoroughly conversant with the details of the business and familiar with the method of figuring for the purpose of making contracts for the heating of every available building located upon the pipe line.

As soon as the capacity of the pipe line has been reached, this additional expense can be dispensed with.

Method of Figuring—The rules used are the same as those given by the highest authorities on the subject of heating, and are the same as those which have been in general use for a number of years.

In determining the amount of heat a given building will consume, measurements are taken of the cubic contents of each room, it being assumed that the atmosphere of a room changes once and must be reheated. The square feet of exposed glass surface is also measured, the loss of heat through one square foot of glass being 75 times as much as the heat consumed by one cubic foot of air. Next the square feet of exposed wall surface is taken, it being estimated that ten square feet of wall surface, in the average well-built house, will lose as much heat as one square foot of glass surface.

By this means we arrive at the total number of feet of radiating surface to heat a given building, allowing one square foot of radiating surface for every hundred feet of cubic contents or its equivalent. An erroneous impression has gone forth to the effect that the heat is charged for according to the number of feet of radiation used, whether this be much or little; but in reality the cost per year is governed by the amount of heat the building will consume, and is not based entirely upon the number of feet of radiation contained in it. It is a well-established fact that hot water as a heating medium is far superior to all known methods of heating. Among the numerous advantages to be had from this particular method is the fact that during the fall and spring months when a moderate amount of heat is desired, this need can be supplied by circulating the water at a low degree of temperature.

The heat from such a system is supplied to the consumer 24 hours a day, and every day upon which heat is needed; the service being continuous and uninterrupted, it gives the consumer the least concern. A crowning feature of this system of heating is obtained by the use of heat regulators, one or more being placed in each building. This insures an even, regular temperature through the house at all times.

*Paper read at the Eighth Annual Meeting of the Ohio Electric Light Association.

TELEGRAPH and TELEPHONE

SPACE TELEGRAPHY.

The Cape Breton station that is to be used for the transmission of Marconi space-telegraphy messages across the Atlantic is now almost completed. The station is located at Glace Bay, on the eastern coast of Cape Breton, on a promontory about 70 feet above mean high water.

The plant consists of four huge towers for carrying the vertical wires, and a group of one-storey buildings arranged at the base of the towers in which is contained the powerful electrical plant which has been specially constructed for the station.

The necessary height for the vertical wires has been attained by the erection of four braced wooden towers, each 215 feet high, at the four corners of a square which measures about 200 feet on a side. Each tower consists of four legs, built up of three by 12-inch plank, the legs being braced together on each face of the tower by three by nine-inch braces. The planking of which the legs are built is laid up so as to break joints as much as possible and secure the approximate strength of a solid 12 by 12-inch stick. The legs are spaced 30 feet from center to center at the base and nine feet from center to center at the top platforms. The foundation of each tower consists of a mass of concrete formed in a hollow square, in which are embedded the 12 by 12-inch sills and the first panels of the lateral bracing. In section this concrete mass is six feet in width by eight feet in depth, the external dimensions of the foundation being 36 by 36 feet, and the internal dimensions 24 by 24 feet.

The towers are tied in such a way that the stress on each tower will be transmitted directly to its own set of cables, every one of which will be doing useful work. The wires are carried from three points on the towers (the lower and upper third and the summit), all wires having an inclination of 45 degrees. The ropes are all made of the best plow steel, the majority of them being 2½ inches, and a few three inches. The method of carrying the aerial wires upon the structure is as follows: Four three-inch cables are strung from platform to platform at the top of the towers, as shown in the diagram (Fig. 3), and from these cables depend 150 aerial wires. These are drawn together and united in the center of the tower into a single cable, which descends vertically to enter the transmithing and receiving house below. The average length of the aerial wires before they meet in the common central cable is about 140 feet.

Mr. Vyvyan, the engineer in charge of the station, states that Marconi has ceased to use the coherer and has substituted a receiver of much greater reliability and capacity. It was always difficult to secure an absolutely reliable coherer of the old type, since out of a hundred of these little instruments 30 or 40 might be good, 30 would be poor and 30 would be absolutely unusable. The new method of receiving adopted by Marconi has a capacity, should it be required, of several hundred words a minute.

The power of the new installation is said to be far greater than would be demanded for transmission to Europe, and it is announced that before the close of the present year messages may be sent direct from Cape Breton or Cape Cod, Mass., to Cape Town, South Africa. It is expected that Mr. Vyvyan, after he has placed the station in operation, will leave for South Africa, where he will superintend the erection of a wireless station at Cape Town. The plan of the Marconi company is to establish, as soon as possible, a chain of long-distance wireless stations in different parts of the world. Within a year, it is expected, there will be one station in Canada, two in the United States, one in Central America or the West Indies, one in South Africa, and one on the continent of Europe, besides the present one at Poldhu, England.

In a recent paper read before the Engineers' Club of Philadelphia, some particulars were given of a method of wireless telegraphy worked out by Professor Fessenden, of the United States Weather Bureau. It consists of a receiver entirely distinct from the coherer [illegible] and character. The sensitive part of the receiver is a continuous conductor and does not depend for its operation, like the coherer, on a vast number of loose contacts. Each time the electrical oscillation passes along the circuit in which the Fessenden receiver is placed a change occurs in the electrical condition of the circuit. This change of condition manifests itself as a click in the telephone receiver. One click is produced each time a complete oscillation passes along the wire; or, in other words, each time the secondary spark occurs at the sending station. If these interruptions are slow, the clicks are difficult to interpret. As the number of interruptions increases the individual clicks form themselves into more or less of a buzzing sound; and if the interruptions are made with a tuning fork, for instance, the telephone receiver will produce the same tone as the sending mechanism gives out. It will be seen that this arrangement lends itself, with slight modifications, to a telephonic system, details of which are not yet ready for publication. General Greely, of the United States Signal Corps, has given a contract to a Philadelphia firm to install the system for the Signal Corps in Alaska, between Cape Nome and St. Michael, a distance of 108 miles across Norton Sound.



FIG. 1.—MARCONI WIRELESS TELEGRAPH STATION, GLACE BAY, NOVA SCOTIA.

An electric light plant is being [illegible] for lighting the municipality of Vernon, B. C. The engine will be supplied by the Waterous Engine Company, of Brantford, Ont.

WIRELESS TELEGRAPHY ON A MOVING TRAIN.

During the passage of the special train on the Grand Trunk Railway between Toronto and Montreal, on October 13th, bearing the members of the American Association of General Managers and Ticket Agents from Chicago to Portland, wireless telegraphic signals were received by the party as the train passed St. Dominique station, at the rate of 60 miles an hour. No special attempt was made to signal to a great distance, but the train remained in touch with the station for from 8 to 10 miles.

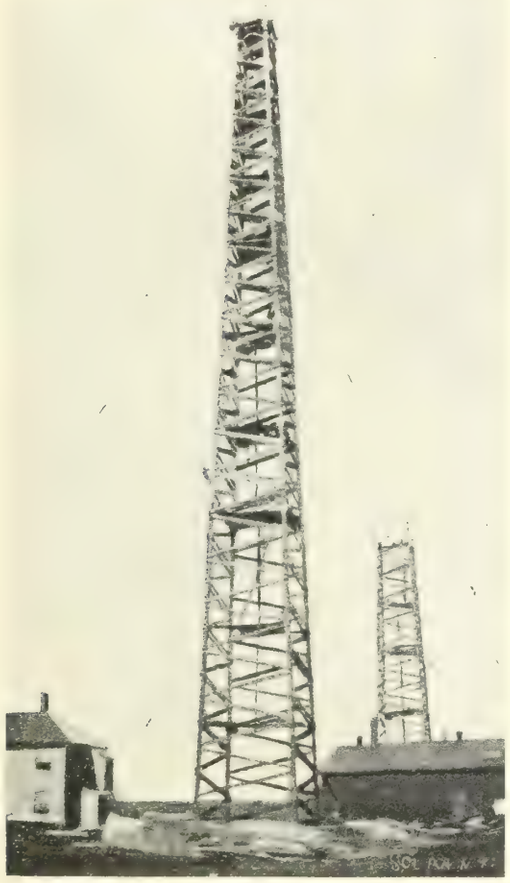


FIG. 2.—ONE OF THE MARCONI TOWERS, SHOWING DETAILS OF CONSTRUCTION.

Two vibrators, 10 to 12 feet, connected with an induction coil of the usual pattern (8-inch spark), served to transmit the waves from the station, while on the train itself the waves were received by a coherer of the ordinary type. A relay rendered the signals audible to the passengers by ringing bells in three cars. The collecting wires were run through the guides for the signal corp inside the train, and extended about one car length on either side of the coherer. Owing to the natural vibration of the train it was impossible to have the relay at the most sensitive point, but the distance to which it was possible to keep the train in touch with the station was considered very satisfactory by the various officials. The apparatus was loaned for the experiments by the Physical Department of McGill University, Prof. E. Rutherford and Prof. H. T. Barnes, assisted by Mr. H. L. Cooke, being present to look after the adjustments. Dean Bovey and Prof. C. H. McLeod, of the Engineering Department of McGill, also witnessed the experiments.

SHORT-CIRCUITS.

The Bell Telephone Company are considering the building of a telephone line between Clayton and Almonte, Ont.

The shareholders of the telephone Company at Harrietsville, Ont., have elected the following officers: President, Dr. W. Doan; secretary and treasurer, James Smith.

The Eastern Telephone Company have just installed a new relay switch-board at Sydney, N.S. The board was supplied by the Northern Electric Company, of Montreal, and installed under the superintendence of Mr. Norris.

The Canadian Telephone Machine Company, which obtained a charter at last session of Parliament, is arranging to establish its headquarters in Ottawa. Toronto and Ottawa capitalists, including Hon. George E. Foster, are interested. The system obviates the necessity of having a central telephone exchange. By taking down from an indicator the figures representing the number with which connection is desired, the same can be obtained without ringing up a central office. It is probable that an experimental line will be established in Ottawa.

Cable dispatches from London, of September 19, gave the following: At a conference with Signor Galimberti, Minister of Posts and Telegraphs, William Marconi submitted plans for the erection of a wireless telegraph station, to cost $140,000, for establishing connection from Italy with the British and American stations. The scheme will be submitted to Parliament. King Victor Emmanuel has bestowed the Cross of the Order of the Crown on Marconi. The French Government has decided to install a wireless telegraphic system in the islands of Martinique and Guadeloupe, owing to the frequent interruptions of the cable service there.

PERSONAL.

It is understood that Mr. J.J. Toole, of Brantford, has accepted the position of general manager of the new Brantford-Paris electric railway.

Mr. Frank Turner, C. E., of Toronto, has accepted the presidency of the Central Ontario Power Company, of Peterborough. Mr. Turner has had a wide engineering experience.

Mr. T. H. Burgess, for the past ten years connected with the Halifax Tramway Company, has been advanced to the position of inspector, an office just created and which is expected to result in the improvement of the service.

Mr. Sylvester Potter, who recently tendered his resignation as chief electrician for the Toronto Railway Company, has accepted a lucrative position in Chicago. Before leaving Toronto the employees of the company contributed generously towards the purchase of a souvenir to mark the high appreciation they entertained of Mr. Potter and the cordial relations that has existed between them. The gifts consisted of a handsome travelling case and a gold chain and locket.

A pretty wedding occurred on October 21st, when Miss May Isabel Crawford Dickson, daughter of the late George D. Dickson, K.C., of Belleville, became the bride of Mr. Roderick J. Parke, consulting electrical engineer, of Toronto. The ceremony took place in St. Alban's Cathedral, Toronto, and was performed by Rev. Canon MacNab. A reception was held at the home of the bride's mother, 1 Howland avenue, after which Mr. and Mrs. Parke left for New York and the Eastern States.

Stricken with appendicitis as he was preparing to sail for America, Prof. Sidney Howe Short, inventor of the first electric

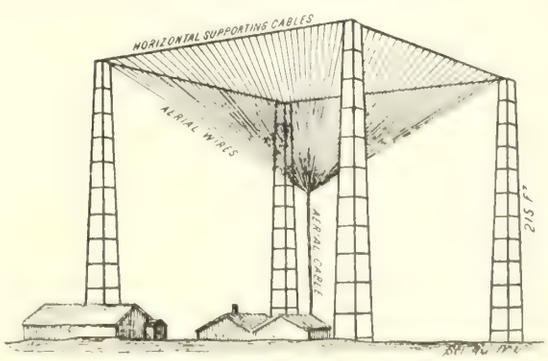


FIG. 3. MARCONI STATION. METHOD OF CARRYING AERIAL WIRES.

car operated in the United States and consulting engineer for Dick, Kerr & Company, London, England, died at his home in London on October 21st. He was 43 years old and had been engaged in electrical work for the last 24 years. Born in Ohio, he was graduated from the Ohio State University in 1878. He established the Short Electric Railway, of Columbus, and at one time was connected with the Walker Electric Company, of Cleveland. He was a professor in Denver University for several years, during which time he invented an electric car, which was tested on the University grounds. Prof. Short, it is said, patented nearly as many electrical appliances as has Mr. Edison.

MONTREAL

Branch office of the CANADIAN ELECTRICAL NEWS,
Imperial Building.

MONTREAL, October 31st, 1902.

The novel scheme spoken of in last issue as going to be adopted by the Electrical Contractors' Association for the province of Quebec re. inspection of interior electric wiring is as follows :—Until such time as the city of Montreal appoints an official inspector (which course is also being worked up by the Electrical Contractors' Association), the members have made an agreement with Mr. W. J. Plews, whose certificates are accepted by the Canadian Board of Fire Underwriters, to inspect all electric light work done by any ot its members. A motion to this effect was put and carried at the last meeting of the contractors and arrangements were made with Mr. Plews to carry it into effect on or about October 15th. This voluntary act ought to prove good faith as well as be acceptable to any fair-minded customer. It is hoped that the electric light supply companies will assist this movemeut by demanding certificates before making connections from other wiring contractors outside the association.

Some local wiremen seem to have got it into their heads that the Electrical Contractors' Association is anti-union and some business men treat it as a combine. Be it known to the former that the association is neither for or against the union, and to the latter that apart from rate per hour to be charged for labor, there is no combine of any sort. The object is to better electrical conditions and assist electrical development. Naturally, so as to control votes to that end only, a union man is not eligible for membership. The success of the association already on the inspector question with the city of Montreal during the few months of its existence is commendable and proves its objects. I quote from one of the dailies : "It is just possible Montreal may have a bureau of inspection for electric wires. It is now suspected that defective wiring is the cause of a great many mysterious fires, notwithstanding the fact that the officials of the electric companies usually protest against statements of this kind. The matter has been given little or no attention up to the present time, and it is now proposed to see what can be done. City Electrician Badger presented a report in favour of establishing a system of inspection at yesterday afternoon's meeting of the Fire Committee. Mr. Badger explained that the cost of a properly equipped staff would be considerable, but he thought a few thousand dollars would do for a start. A sub-committee was appointed to study the matter with instructions to report as soon as possible.

The case taken by several insurance companies against the Lachine Rapids Company, referred to in last issue, promises to be a big fight. It is on account of the fire at Ayer's cold storage warehouse. It is alleged that the fire was electrical and due to high tension current entering from the Lachine circuit during break-down of transformer. It looks as if every electrician of note in Montreal will be called in on one side or the other.

Fogarty Bros., Montreal, have secured the contract for installing a complete electric light plant in the new mill of William Rutherford, Sons & Company at St. Henri, Que.

The city of Winnipeg now owns its fire alarm system, recently installed under the supervision of Mr. F.A. Cambridge, city electrician. For the past eighteen years the system has been operated by the Bell Telephone Company. The principal improvement introduced in the new system is the substitution of insulated wire for the bare wire hitherto in use ; another improvement is the subdivision of the boxes into a greater number of circuits Provision is made for the introduction of the manual system instead of the automatic repeater, but this change may not be made for some time. The switch-board in the operating room is 7.10 by 6.5 inches, of red Tennessee marble, manufactured by the Western Electric Company, of Chicago. It has a capacity for eight circuits, six now in use and two spare circuits. Each battery, when fully supplied, has a capacity for 48 hours' supply. Current is obtained from the electric plant of the Hudson's Bay Company. The outside system comprises 40 miles of wire, most of which is heavily insulated. There are at present connected to the system 83 boxes, and 10 additional ones have been ordered.

ANNUAL DINNER OF STATIONARY ENGINEERS.

The usual jolly crowd assembled at the Walker House on Thanksgiving Eve, October 15th, to participate in the sixteenth annual banquet of Toronto No. 1 Canadian Association of Stationary Engineers. The large dining hall was capable of providing no more than ample accommodation for the large number of engineers and their friends. The menu card was prefaced with the quotation "Hunger is sharper than the sword", as if to whet the appetites of the party, but such was not necessary, as the dainty viands were a sufficient enticement in that respect.

The duties of chairman devolved upon Mr. R. H. Johnston, President of Toronto No. 1, who lost no time after the supper in proceeding with the programme of toasts and song. After "The King" had been duly honored. Mayor Howland, who had just entered the room, was asked to make some remarks. He complimented the engineers upon the splendid gathering, and announced himself to be in sympathy with the aims and objects of the Association. The name "stationary engineer" seemed to him a misnomer, as engineers were not stationary but were making rapid advancement. Upon concluding his remarks he was warmly applauded. Coupled with the toast "Toronto, the Queen City", was the name of Ald. Woods, who made a somewhat humorous speech.

"Our Guests" called for remarks from G.B. Towers, J.J. Bell, and Capt. Donnolly. Capt. Donnolly has recently removed from Kingston to Toronto. He has been prominently connected with shipping and marine engineering and was for several years inspector for Lloyds, of London, England. It was time, he said, that the engineers had obtained greater recognition in this country. It was most necessary that an engineer should be capable of efficiently performing his duties, as both life and property depended upon him. There has been no time in the past, he believed, when the good engineer is more sought after than he is to-day, and he urged every young man to strive to become absolute master of his business, whether it be engineering or otherwise. He thought every person who had anything to do with running an engine should join the engineers' association, particularly as its aims were educational.

Everyone smiled when Mr. J. J. Main rose to respond to the toast of "Our Manufacturers," but the expected story was not forthcoming. Mr. Main's remarks were confined to the boiler-making business, with which he is associated. He said present prospects could not be brighter. Every boiler-maker that he knew had all the business he could handle, and many of them were in the happy position of being able to discriminate as to the work which they would accept. He regretted to say that there were many defective and worn-out boilers still in use. He knew of boilers that had been condemned and replaced by new ones, and these same boilers had been sold for saw mills and other purposes where 100 pounds pressure or more would be required. There could be only one result—a disastrous explosion sooner or later. Mr. Main had recently returned from a convention of boiler-makers at Atlantic City, N. J., where he had the honor of being the only Canadian present. Mr. Baker, of Westman & Baker, and Mr. Owen, of London, England, also spoke in response to this toast. To the toast of "The Executive" Mr. H. E. Terry and Mr. A. M. Wickens replied. "Toronto No. 1" was then toasted and responded to by the president, Mr. R. H. Johnston.

The musical programme was provided by Messrs. R. A. L. Gray, McLean and Fletcher.

The committee in charge of the dinner were unceasing in their efforts to entertain their friends, and they succeeded admirably. This committee was composed of R. H. Johnston, president; G. C. Mooring, chairman; James Bannon, secretary-treasurer; Charles Moseley, A. M. Wickens, N. V. Kuhlman, W. H. Johnston, W.A. Woodbridge, James Huggett, and A.J. Butcher.

The Otonabee Power Company, of Peterborough, Ont., turned on the power in their new plant on September 23rd. The power house is located about four miles north of Peterborough, and the present installation has a capacity of 2,000 horse power. The water wheels consist of three 68-inch Samson turbines, of the verticle type, manufactured and installed by the William Hamilton Manufacturing Company, of Peterborough. The generators and other electrical apparatus were furnished by the Canadian General Electric Company.

BY THE WAY.

Under the title of "Dooley's Invention," a Montreal correspondent sends us the following, with apologies to F. P. Dunne :

" Dhrink up yer beer Hennessy an shep into me labortory," said Mr. Dooley. " An ilectric shock 'll do yer owld lame back more good than anything Oi' can think iv. 'Tis in here thot me friends Edison, Marconi, Frid Thomson, Gawrge Hill, an' a few others akelly as much, do be meetin' twist a week fer to perfect th' noo invintion which Oi 'ave been workin' on fer years.

" Wudden't ye be sorrphrised Hennessy, on a warm day at th' mills, if ye just thot iv a cool schooner, an' it all 't wanst, lo and behold, it just popped down before yer thirsty face? Or make up yer moind any toime in th' day that 'tis six o'clock an' immegitly th' whistle 'd blow ? If ye can stretch yer immagination to that extent ye have me invintion iu a nutshell.

"Av coorse, when Oi git it on th' market, 't'll be neat an' convaynient fer carryin' in yer vist pocket, but don't ye buy th' insthrument till Oi giv ye a few demonstrations, fer ye'd be shure to wish fer a house an lot an it 'd come down so quick that th' owld woman 'd 'ave t' hire a dridge fer to dig ye out.

" Oi bet me brain looks loike a magnified dhrop iv Montreal wather since Oi'v been calculatin", studyin' an expirimintin'. 'Tis great spoort Hennessy,

$$A = \frac{12 \times 11m \times At}{Eb - e} \qquad S = \frac{119 \times 60 \times 10^8}{252 \times 2{,}950{,}000} = \text{Oi dinnaw.}$$

Ye see $C = \frac{E}{R}$ is about wan iv th' first things ye run up aginst. Av coorse th' rise in timperature increases th' resistance, th' same as t'would in yer own case Hennessy, much depindin' on th' lingth av th' circuit an' th' toime ye've sthopped at it. Ye've loikwise to consider th' dhrop in potential, b't after ye've raised the E. M. F. at th' ginerator things 'll commince fer t' feel aisy fer ye if ye can make up yer moind thot ye've sufficient margin, an' thin yer all roight fer Sunday.

Call agin Hennessy, I'll enlighten ye more if ye feel intherested. Oi niver knew befoor that ye cud divide an E by an R, ses Hennessy.—R"ats.

THE LATE MR. JOHN MOODIE.

One of the prominent citizens of Hamilton, Ont., in the person of Mr. John Moodie, Sen., passed away on October 19th at his residence, "Blinkbonnie", Bay street north, in that city. Mr. Moodie had been indisposed for several months, and his demise was not unexpected. He was a well-known business man and had been prominently connected with the industrial development of Hamilton and in late years with its advancement electrically.

Deceased was born in Newton-Steward, Ayrshire, Scotland, and came to Hamilton when twenty-two years of age. Thus forty-six years of his life were spent in that city. He conducted a large fancy goods store and, with his sons, founded the Eagle Knitting Company. About eight years ago he retired from these enterprises, leaving them entirely to his sons. Recognizing the possibilities in the electrical field, he became one of the founders and original directors of the Cataract Power Company, and at the time of his death was a large shareholder in the Hamilton Electric Light & Cataract Power Company. Mr. Moodie was treasurer of the company, but a few months ago, owing to failing health, his duties were transferred to his son, Mr. James R. Moodie. It is said that he left an estate valued between $450,000 and $500,000, a large portion of which is Cataract Power Company stock.

At a meeting of the Board of Directors of the Hamilton Electric Light & Cataract Power Company the following resolution was unanimously passed: "The Board of Directors of the Hamilton Electric Light & Cataract Power Company places on record an expression of its sincere sorrow and regret that John Moodie, the Treasurer of the company, has been called away from this life to his eternal rest. Mr. Moodie was one of the few pioneers in the history of this company's enterprises,and at all times showed the utmost confidence in the company's future prospects. His co-directors ever found it a genuine pleasure to be associated with Mr. Moodie in all business matters, and the company's success has been in no slight measure due to his acknowledged reputation in the community and business circles as a man of high character and undoubted integrity. The directors extend their warmest sympathy to the grief-stricken widow and the members of the family in the hour of their affliction and bereavement."

A REMARKABLE SPECIMEN.

The illustration herewith shows a straight line hanger and ear which were taken from the line of the Mill Creek Valley Street Railroad Company, St. Bernard, Ohio. The damaged appearance of the hanger and ear was caused by a dead short-circuit between the trolley and ground. It seems that in some way the positive trolley wire came into contact with the negative wire on one of the cars, causing a short circuit of the line. The circuit breakers, being set at 2000 amperes, would not open up until the



DAMAGED HANGER AND EAR.

engineer opened the circuit by pulling out the breaker, and a the time that was done, he noticed that the short circuit was carrying 150 amperes.

An examination of the cut will show the extremely disastrous nature of the arc caused by the short-circuit, which was sufficient to melt entirely away the ends of the trolley ear, and also the lower part of the skirt of the hanger supporting it. The hanger in question was a type D hanger,made by the Ohio Brass Company, of Mansfied, Ohio, and the insulation was its well known "Dirigo" make. Despite the fact that the hammer and ear were so badly damaged by the arcing that the stud bolt of the hanger was partially melted away and fused on to the boss of the ear, the insulation was practically uninjured, with the exception of a slight charring of it at the lower edge of the insulated bolt. A test of 500 volts afterward applied between the hanger casting and ear showed that the insulation of the hammer was still perfect, a fact which, in itself, speaks well for the heat-resisting and insulating properties of "Dirigo" insulation, which is sold in Canada by the Canadian General Electric Company, Limited.

A dispatch from Glasgow, Scotland, dated October 6th,stated that the Clyde Valley Electrical Company had placed a contract with the Westinghouse Electric Company for the equipment of two generating stations to supply power for industrial purposes over an area of 75 miles. The initial installation is to be of 6,000 horse power. It is believed that this will be the first of a series of great power stations to be built in the United Kingdom.

TRADE NOTES.

The Canadian Heine Boiler Company are installing a new Heine boiler in the works of the Toronto Carpet Company, King street west, Toronto.

Dick, Kerr & Co., Limited, through their Canadian office at Kingston, Ont., have just been given an order by the Lakefield Portland Cement Company, Lakefield, Ont., for one 1,000 k. w. alternating current generator and one 450 k. w. synchronous motor.

Renfrew is to have a new 200 barrel flour mill. The building is to be brick with a 50,000 bushel elevator attached. It will be a full Gyrator system and the machinery throughout will be furnished by the Goldie & McCulloch Company, of Galt, Ont. This firm we learn has much work booked in their mill building department and are very busy in all other departments.

The R. E. T. Pringle Co., Ltd., Montreal, are calling the attention of their friends and customers to the fact that they have arranged with the Pittsburgh Transformer Company to handle the sales of Pittsburg transformers in Canada. In offering this line to the trade, they point out the fact that these transformers have been very favorably known in the Dominion for reliability and efficiency. In soliciting the patronage of their friends and customers they feel confident that these will give very general satisfaction.

Mr. Geo. C. Rough, for the past six years connected with R. E. T. Pringle, has severed his connection with that company and opened offices for the Packard Electric Company, of St. Catharines, in Montreal. Mr. Rough is one of the best known electrical men in the Dominion, particularly in the eastern provinces, where he has been located for several years. Mr. Rough's offices will be located in the Street Railway Building, Corner Craig St. and Place D'Armes, Montreal. The business of the Packard Electric Company has been expanding with wonderful rapidity and the establishment of the Montreal office will doubtless facilitate a quicker handling of their business in the east. Mr. Rough's friends will wish him success in his new associations.

From the Canadian office of Dick, Kerr & Company, Limited, London, England, we have received five splendid catalogues bearing the following titles: "Continuous Current Generators"; "Rolling Stock for Electric Traction; "The English Electric Manufacturing Company, Limited;" "Electric Traction on Highways — Some Results of High Acceleration;" "Electric Traction at the Cape."

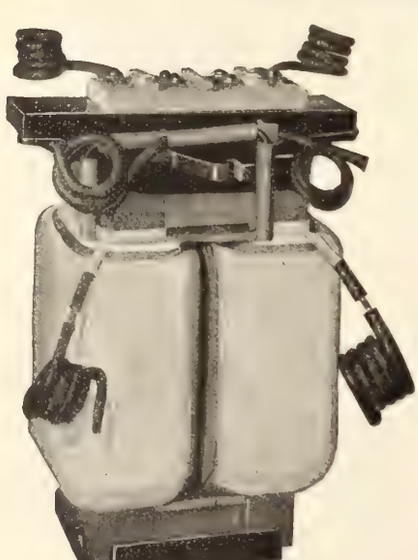
In operating oil transformers it has been noticed that the oil will occasionally follow the stranded flexible cables, due to capillary attraction and drip from the wires; this not only depletes the transformer of oil, but it is also liable to cause damage to articles, or merchandise, which may happen to be placed below such a transformer. The Pittsburgh Transformer Company has for a long time adopted a simple expedient to remedy this trouble, and it has been proven to be entirely successful. By this method the cable is cut in two just above oil level, within the transformer case, and a solid wire inserted, thus giving a portion of the cable a solid section for about one inch of its length, along which the oil can travel; this portion is then insulated by means of fibre tubing. Another improvement, which the Pittsburg Transformer Company has recently directed attention to, is the new cables with which the transformers are fitted. In this case the insulation instead of consisting of rubber is composed of a treated paper, covered with a heavy braid, and finished with a weather-proof compound. The chief feature of these cables is that they are entirely unaffected by oil, and will not deteriorate under the longest service. Their superiority to rubber covered cables is at once apparent—for it is well known that rubber coverings are very quickly destroyed by oil.

It is fairly safe to judge men by the papers for which they subscribe. Good papers attract good readers. Advertisers should bear this fact in mind. When they use high-class newspapers they should see to it that the text of their advertisements comports with the dignity and merit of the papers so used.—Printers' Ink.

DYNAMO FOR SALE.

A 20 k. w. 2000 R. P. M., S. K. C. Royal Electric Generator in good condition. Address "J. G." Care of ELECTRICAL NEWS

Pittsburgh Transformers



THE TYPE K TRANSFORMER
(Core Type.)

When you consider the well known reliability and efficiency of the Pittsburgh Transformer
and
the promptness and care which the Pittsburgh Transformer Company has always given to orders for their goods,
can you not see that it will pay you to use them?
Having taken the general agency for the Pittsburgh Transformer we solicit your patronage.

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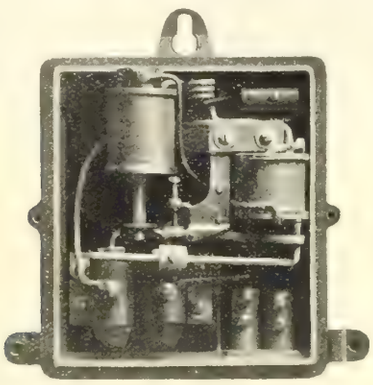
105 Prince William St., St. John, N. B.

172 Dalhousie St., Montreal.

18 Toronto St., Toronto, Ont

THE "LACEY" CONTROLLER.

During the last C.E.A. convention held at Quebec City, among the many interesting things none seemed to attract so much general attention as the exhibit of the "Lacey" Current Control by the R. E. T. Pringle Company, Limited. This efficient piece of apparatus, of which an illustration is shown, has proved in the last few months to have practically solved the flat rate problem; inasmuch as the old cry that a customer was limited to a stated number of lamps has been done away with, and it is now possible to have a number of lamps wired; yet only use a given number.



THE "LACEY" CONTROLLER.

The R. E. T. Pringle Company, Limited, of Montreal, report a ready sale; and a pamphlet descriptive of the above we are sure will be cheerfully mailed on request.

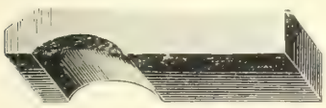
LIQUID FUEL.

It would seem that liquid fuel is to be king in the future. Recent experiments in British warships have proved that two tons weight of oil are equivalent to three tons weight of coal, and 36 cubic feet of oil to 69 cubic feet of coal as usually stored in ship's bunkers. Far fewer stokers are needed where oil is used than is the case with coal, and the cleanliness of oiling as compared with coaling is, of course, remarkable. One of the chief advantages of liquid fuel, so far as the mercantile marine is concerned, is the increase in weight and space available for freight. It has been stated that there would be a gain in weight of 1,000 tons in the freight of a first-class Atlantic liner, as well as a gain of nearly the whole of the bunker space. It has been estimated that for most ships 25 per cent. of the space now occupied by coal bunker storage could be utilized for cargo by the transfer of the fuel in a liquid form to the double bottom and other parts not now of any direct use.

LARGE ENGINE CONTRACT.

The Hamilton Electric Light & Cataract Power Company, of Hamilton, have just placed an order with the Goldie & McCulloch Company, Limited, of Galt, for one of the largest steam plants ever installed in Canada. There will be two cross compound engines of 1,500 horse power each. This is another evidence of Canadian industry, and we congratulate the Goldie & McCulloch Company that they are able to undertake so large a contract.

SWEDISH CHARCOAL IRON SHEETS, BARS, RODS, STRIPS AND STAMPINGS.



Magnet Forgings, Slabs, Bars In the Rough and Machined.

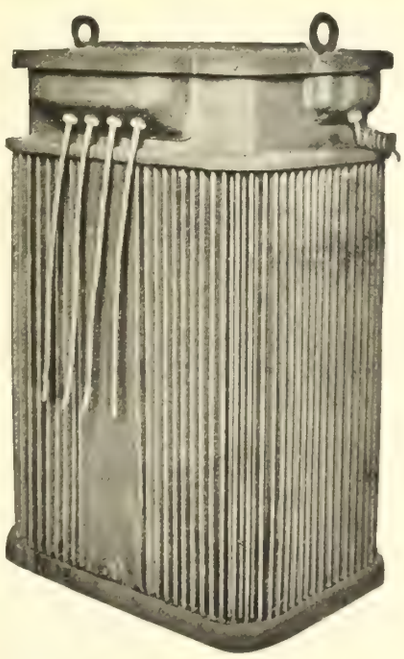
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50 K. W. Type N Transformer.

Westinghouse Type N Transformers

have two primary and three secondary voltages. Each secondary voltage can be varied to suit either the varying line voltages of an extensive transmission system, or to give special voltages from standard circuits.

All transformers are arranged for three-wire secondary distribution, and the secondary coils are cross-connected to give equal voltages on both circuits, even with large, unbalanced loads.

Sizes: 1-2 to 50 K. W.

Frequencies: 6,000-16,000.

For Circular 1060, address

AHEARN & SOPER LIMITED

Ottawa, Canada.

131

PUBLICATIONS.

"Galvanic Batteries" is the title of a work by S. R. Bottone just issued from the press of Whittaker & Company, 2 White Hart Street, Paternoster Square, London, E. C. It contains descriptions of every known battery of any practical use, also data as to E.M.F., internal resistance, and adaptability to particular requirements. The information furnished is comprehensive and of practical utility. The price of the book is $1.25.

A neat catalogue entitled "Steam Boilers" has been received from the Robb Engineering Company, Limited, of Amherst, N.S. It is intended to explain briefly the principles by which fuel is used to generate steam, to give an idea of the best construction of steam boilers for strength, durability and efficiency, and to describe and illustrate the construction and working of the Mumford boiler manufactured by the Robb Company. Mumford boiler testimonials are also a feature of the book.

The R. E. T. Pringle Co., of Montreal, have recently established an office at No. 18 Toronto Street, Toronto, in charge of Mr. A. Esling.



DON'T BUY AN EXPERIMENT....

The "Triton" Marine Gasoline Motors are manufactured by a firm which has made a specialty of Marine Gasoline Engines for years, and they are the

Simplest, Safest and Most Reliable Motors on the market

(from 1½ to 100 horse power). Engines in successful operation from Halifax to Vancouver. Send for testimonials.

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Persons desiring to obtain a city, state, or government license, to operate a steam plant, will find "The Hawkins' Engineers Series" valuable assistance, both for study and reference.

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A complete catalog and description of the books sent on application.

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The cost is only 3d. per week including postage.

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Moreover, regular subscribers are allowed to advertise without charge in the paper—See the rules.

Greer Tested Fuse Wire



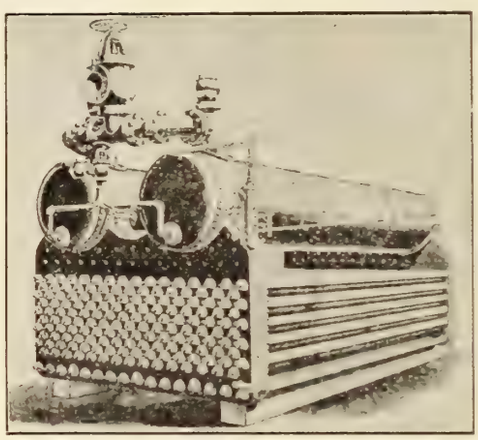
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Full weight guaranteed to each spool. Warranted to be absolutely uniform, reliable and accurate. Send for catalog.

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THE CANADIAN HEINE SAFETY BOILER CO.

JOHN J. MAIN, Manager.

Esplanade, Opp. Sherbourne St., Toronto

HIGH CLASS

Water Tube Steam Boilers

for all pressures, duties and fuel From 75 to 600 h. p. each. N. B.—We do not make small boilers.

REFERENCES—The Toronto Electric Light Co., Limited; The T. Eaton Co., Limited; The Massey-Harris Co., Limited, The Gutta Percha Rubber & Mfg. Co., Dominion Radiator Co., Central Prison, Foresters' Temple, Toronto City Hall, where boilers may be seen working

RECENTLY PUBLISHED

THE CANADIAN HAND-BOOK OF STEAM AND ELECTRICITY

BY WILLIAM THOMPSON

170 Pages, Illustrated In Strong Cloth Binding

THE preparatory chapters are devoted to a concise explanation of the foundation principles of Mathematics, a knowledge of which is absolutely necessary to the study of Electricity and Engineering. In the succeeding chapters the student is led by gradual stages to a more complete acquaintance with these subjects, and is equipped with knowledge to enable him to pursue his researches to any further extent.

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DESK TELEPHONE

as illustrated is a handsome instrument, perfect in construction and design, with no exposed contacts or wires, and has many other points of advantage.

Fully guaranteed and sold on merit.

Write us. Our prices are right.

John Starr, Son & Co., Limited, P. O. Box 448 HALIFAX, N. S.

SPARKS.

Messrs. H. McLaren & Company, 706 Craig street, Montreal, have been appointed agents for the Hart Emery Wheel Company, of Hamilton.

The thousands of persons who every year spend a portion of the summer on the Muskoka Lakes will be pleased to note the announcement in the press by the Bell Telephone Co. that long distance communication has been established between Severn Bridge, Gravenhurst, Bracebridge and Toronto.

The London, Aylmer & North Shore Electric Railway Company, of New York city, was incorporated at Albany on October 11th, with a capital of $100,000, to construct and operate an electric railroad from London to Port Burwell, Ont. The directors are: J. H. Hitchcock and J. E. Howard, New York city; R. E. Lenton and W. A. Dorland, Grand Rapids, Mich.; and H. Stephens Melyon, Aylmer, Ont.

The Robb-Mumford Boiler Company of the United States has been incorporated in New York, to manufacture the products of the Robb Engineering Company. Messrs. D. W. Robb, president of the Robb Engineering Company, J. F. Stairs, president Nova Scotia Steel & Coal Company, and J.A. Mumford, engineer, of New York, are among the incorporators. Owing to the customs duties and the fact that the works at Amherst, N, S., are at present taxed beyond their capacity, it was considered necessary to manufacture in the United States in order to compete in that market.

THE GOODENOW GASOLINE ENGINE and MOTOR COMPANY

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Montreal Electric Company, Agents.

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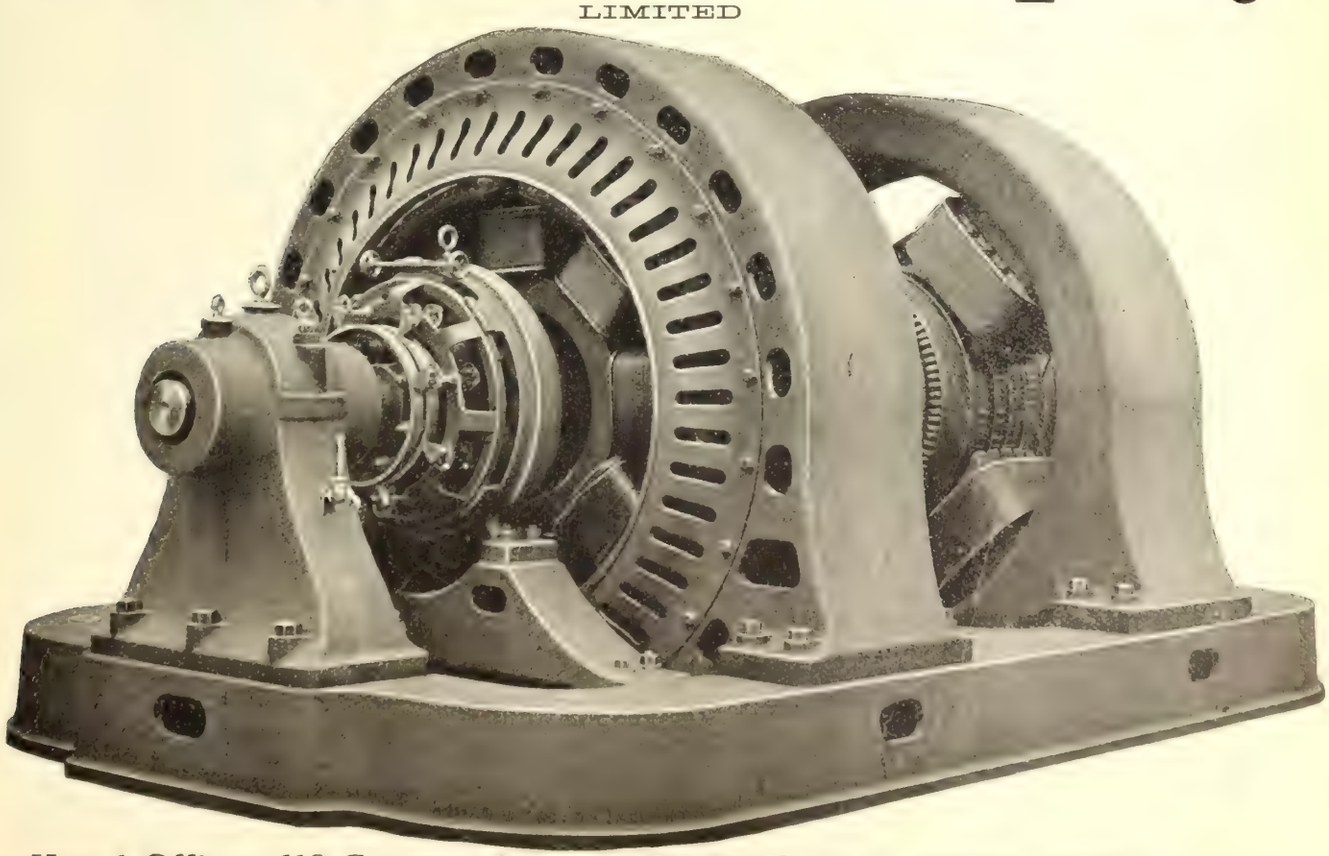
The ORIGINAL and only GENUINE "Circular Loom." Has been in the market for eleven years, and handled by us for over eight years. No other substitute has ever taken its place for quality and adaptability. For price lists, discounts and full information, address

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A TRICK WITH THE TELEPHONE.

It is not generally known to users of the telephone—and perhaps it is just as well for the interests of the service—that when the ear-piece of a receiver is held to the month-piece of the transmitter a more or less shrill tone or whistle is heard in the receiver. This occurs when the apparatus is in good working condition, and when the transmitter is on short circuit. This effect is seemingly due to a series of reactions analagous to, but much more complex than, those which occur in an electric bell when its circuit is closed. A movement of the diaphragm of the receiver towards its magnet tends to weaken the pressure on the carbon of the transmitter, which causes a weakening of the current, allowing the diaphragm to fall away, with the further result that the air column is compressed, increasing the pressure on the carbon again, and also increasing the current strength, whereby the diaphragm is again attracted, and this action is repeated over and over again. Recent investigation of these phenomena indicates, as might be anticipated, that it is dependent upon the fundamental rate of vibration of the receiver and transmitter, the length of the air column enclosed between them, and also the oscillation period of the circuit. The above references to the attraction of the diaphragm and to its falling away add, perhaps, rather broad terms when it is considered that as near as can be calculated, the amplitude of vibration of the diaphragm of the receiver in reproducing speech is about one-twenty-mil ionth of an inch.—Cassier's Magazine.

Clarkson School of Technology Thos. S. Clarkson Memorial Potsdam, N.Y.

Courses leading to degrees of Bachelor of Science in Civil, Electrical and Mechanical Engineering, comprising four years of thorough training and resident collegiate work in theory and practise of engineering. Well equipped shops, laboratories, drafting rooms and power plant. Located near Massena and the engineering developments along the St. Lawrence River. Healthful climate. Tuition moderate.

WM. A. ALDRICH, Director.

ELECTRICAL REPAIRS

In the large and well equipped factories where the manufacture of electrical apparatus is carried out under the piece work system, they find that repair work or apparatus sent in to be repaired or rewound interferes with this system, and in many cases they would prefer not to do this kind of work, as it is almost impossible to do it with dispatch and at a reasonable price. Knowing the above to be a fact,

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have arranged their works for repair work only. They keep armatures of nearly all makes of dynamos in stock, which they loan while repairs are being made. Their factory is so arranged that they can run night and day, and work can be finished in the shortest possible time. Telephone Main 3149.

WANTED—By Young Man, good recommendation and of 15 years' experience in electrical contracting and construction and contracting work, position as manager of electric light company for either municipality or company. "Manager," ELECTRICAL NEWS.

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THE "RADIANT SHELBY"

gives the most useful light from the least amount of current, which can be easily demonstrated by burning with any other make of lamp, in the same room.

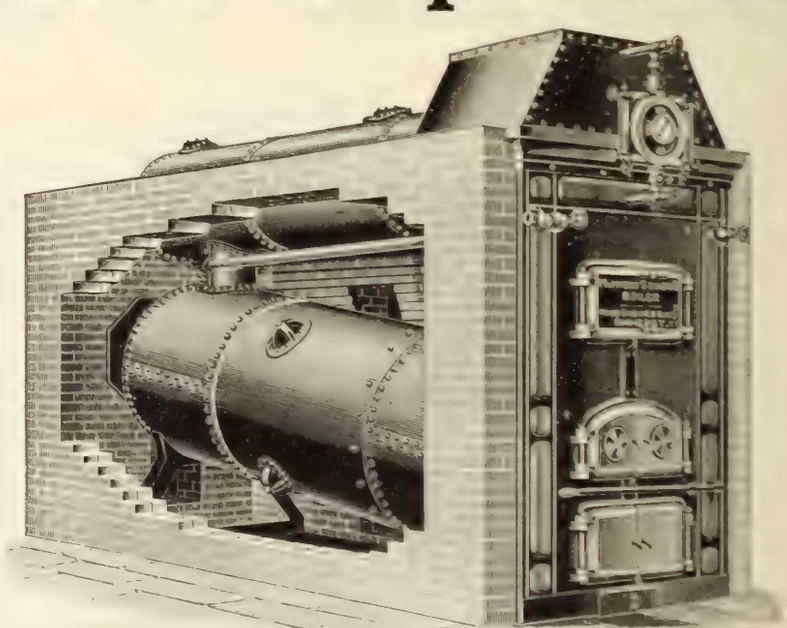
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A Customer Says:

We are well pleased with the Mumford Standard Boiler purchased from you a year ago. It steams very quickly and we find on comparing our coal bill with the year previous that we have saved 25 per cent., although we are using considerable more power and have double the area to heat.

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AGENTS: *William McKay, 19 McKenzie Crescent Toronto. Watson Jack & Co., 7 St. Helen Street, Montreal.*

SPARKS.

The Stewart-Arbuthnot Machinery Company, of Winnipeg, are installing electric lighting plants for the Arrow Milling Company, Birtle, Man., McCulloch & Company, Rapid City, Man., and Smith & Hunter, millers, Carnduff, Assa.

J.E. Cornwall, an employee of the power house at Vancouver, B.C., was terribly burned by coming in contract with live wires. He was working behind a swith-board when he received a slight shock which pitched him forward onto a coil of wires.

Mr. Willard R. Green, of New York, the representative in America of the English Marconi Company, has recently been in Canada for the purpose of completing the organization of the Marconi Company for this country. He states that the company will do a trans-Atlantic business with England and other countries and also an inland telegraph business throughout the Dominion and Newfoundland. The station at Glace Bay, N.S., is now practically finished and has cost approximately $100,000. This station will belong to the Canadian company and will be used for long distance and oceanic business. Other inland stations will be built for inland business. These cost much less, depending upon the distance of operation and varying from $1,000 to $25,000.

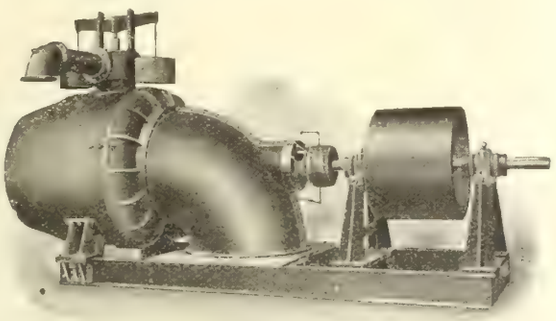
o——A Single 27 inch——o

Victor Turbine

On horizontal shaft is shown by the cut herewith. The water is discharged through one end through the draft tube, and in this case the usual end thrust connected with single wheels is entirely provided for.

The Victor Turbine is Built

upright or horizontal, single or in pairs, and in a variety of styles to meet the requirements of almost any situation.



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Air Compressors

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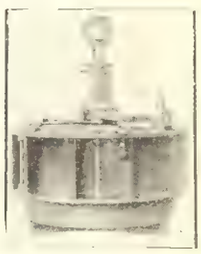
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It settles disputes, and if referred to before wiring will prevent disputes.

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Address orders to Canadian Electrical News, Toronto, Can.

SPARKS.

The Jacques Cartier Water Power Company are now lighting the streets of the city of Quebec, their contract having commenced on November 1st.

The name of the Sherbrooke Gas & Water Company, Sherbrooke, Que., has been changed to the Sherbrooke Power, Light & Heat Company.

The town council of Toronto Junction, Ont., have accepted the tender of the Canadian General Electric Company for electrical apparatus for a municipal plant, their figure being $3,580.

The British Columbia Electric Railway Co. have announced the adoption of a system of profit-sharing. It is proposed that the regular employees shall receive as their share of the profits one-third of the amount available for dividends after the ordinary shareholders have received four per cent. It is believed that both the company and the employees will gain by the innovation.

The electric power plant of the Shawinigan Water & Power Company, of Shawinigan Falls, Que., is now in operation. There are 6,000 horse power capacity in water wheels and 5,000 horse power capacity in generators. The wheels were built by the I. P. Morris Company, of Philadelphia, and the electrical apparatus by the Westinghouse Electric & Manufacturing Company, of Pittsburg. It is intended to deliver power to the Lachine Rapids Hydraulic & Land Company at Montreal.

Councillor Duncan Pearson, of Carberry, Man., has tendered his resignation as a protest against a compromise made by the council with the Acetylene Gas Company. The company was under contract to furnish the town with a certain candle power light for $500 per annum. When the bill was sent in the council declined to pay the amount in full on the ground that the contract service had not been supplied. After negotiations with the company a compromise of $400 was made, to which Mr. Pearson objected, and accordingly tendered his resignation.

At the meeting of the British Columbia Electric Railway Company held in London, Eng., on September 9th, resolutions were passed enabling the company to raise further capital. The chairman (Mr. R.M. Horne Payne) said that since 1897 their profits had risen from £20,000 to £45,000 per year, and that the equivalent number of 8 c.p. lights had increased from 19,000 to 69,000, with a prospect of a further large increase, both in earnings and in number of lights. It was essential that further capital should be raised in order to provide the machinery necessay for supplying further demands for current.

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WATEROUS

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BRANCHES
WINNIPEG, VANCOUVER.

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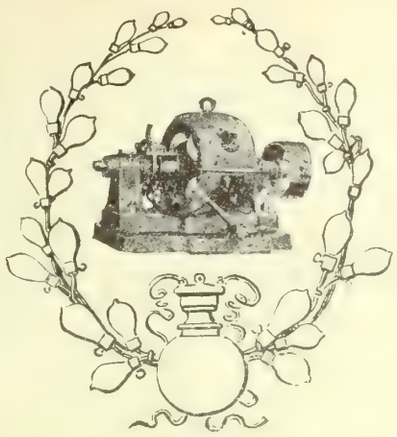
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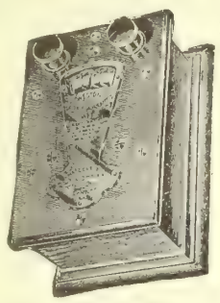
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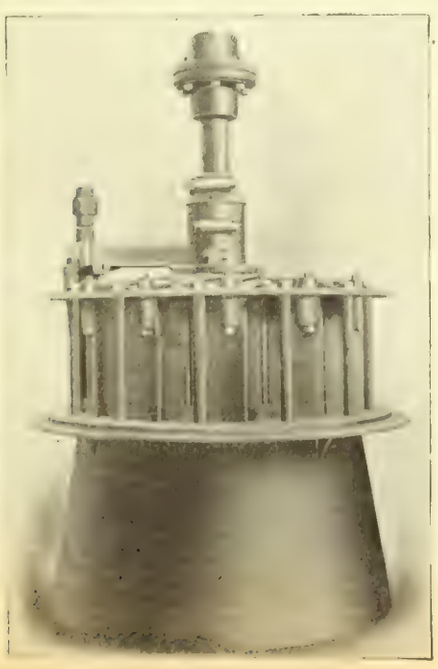
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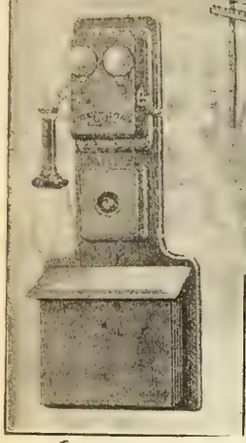
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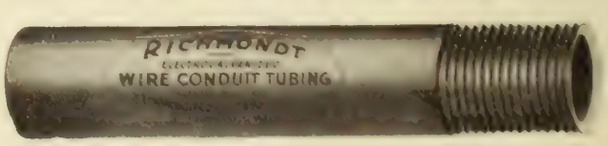
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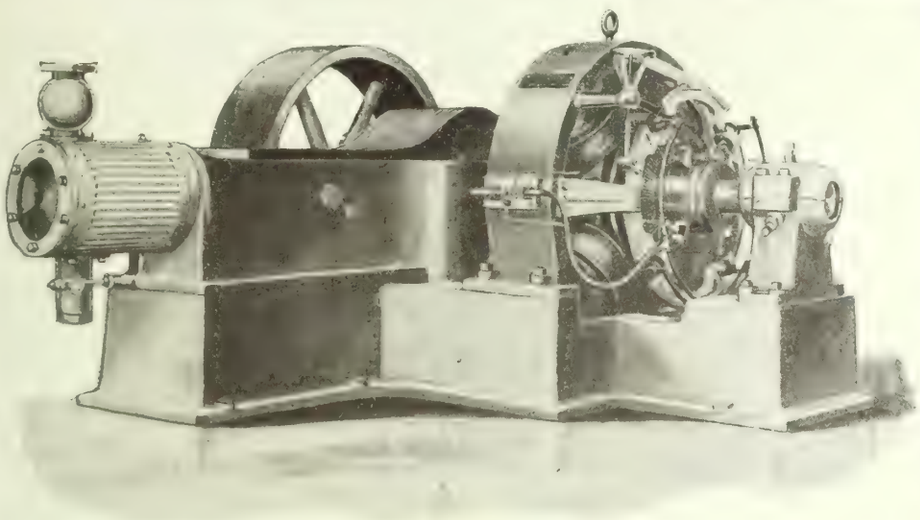
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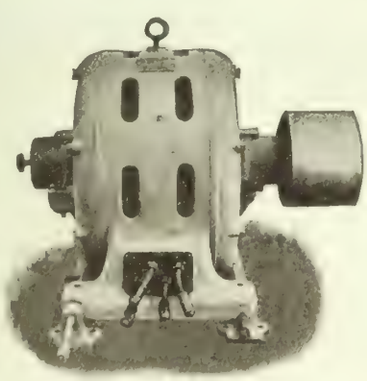
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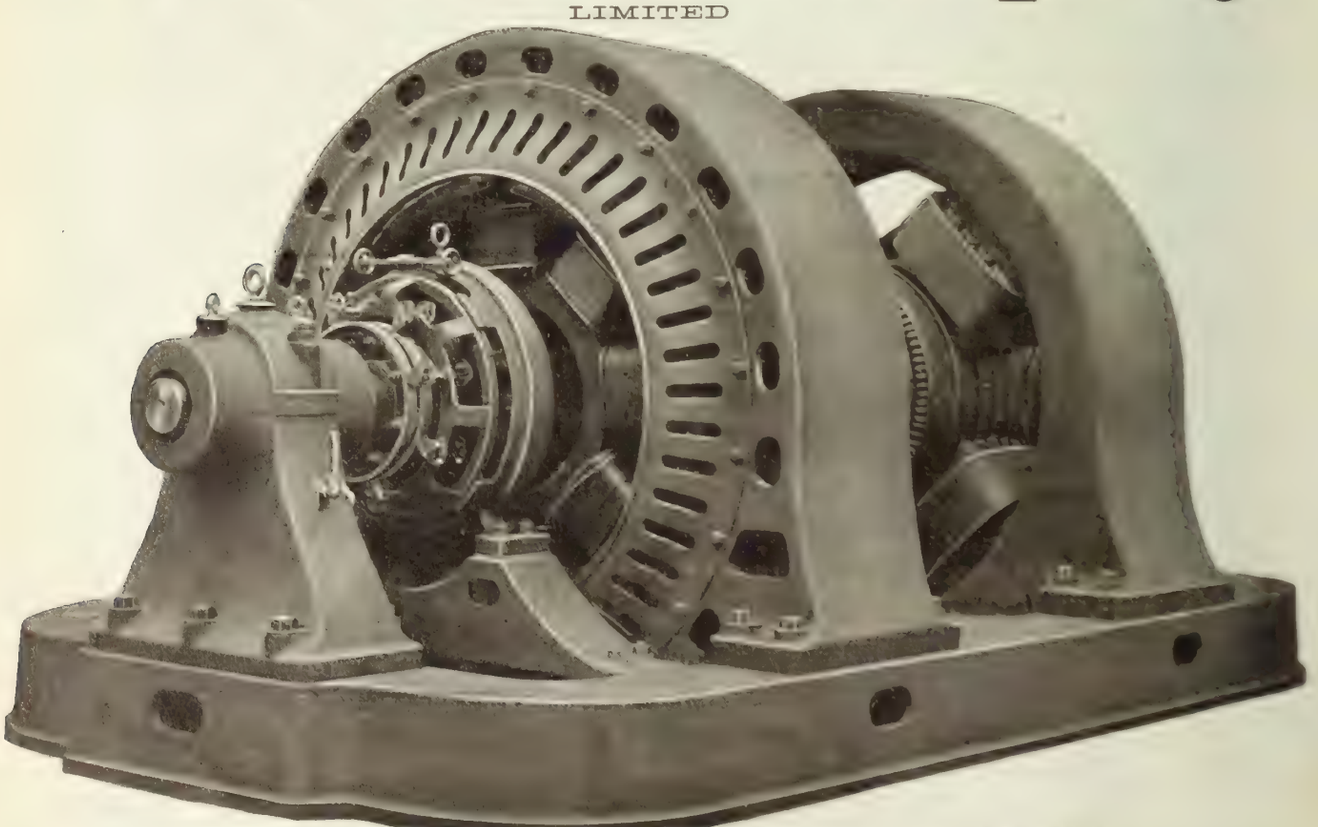
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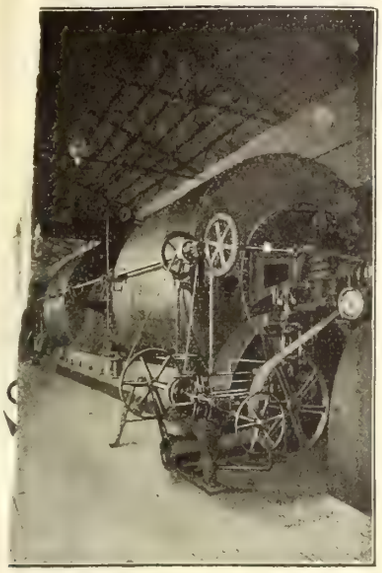
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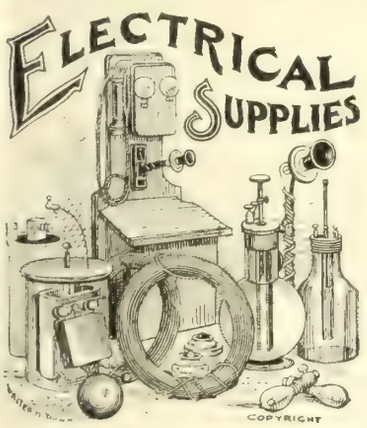
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SPARKS.

It is probable that the street railway at Sherbrooke, Que., will be extended.

The International Buckle Company are installing an electric light plant in the village of Westport, Ont.

The Toronto Railway Company are building a new storage shed on King street east, near the Don river.

The city council of St. Thomas, Ont., are taking steps to acquire the electric and gas plants for the corporation.

The Cataract Power Company, of Hamilton, is said to be preparing to extend their radial railway from Burlington to Oakville.

Mr. E. R. C. Clarkson has been appointed permanent liquidator for the Gee Electrical Engineering Company, Limited, of Toronto.

The ratepayers of Barrie, Ont., will shortly vote on a by-law to raise money to purchase electric light meters and transformers.

A company is applying for incorporation to construct railways in British Columbia on the nono-rail principle. Mr. C. H. Lugrin is acting as solicitor for the applicants.

The new power house of the Ottawa & Hull Power Company at Hull, Que., is nearing completion. One generator has been installed and the switch-board is being set up.

The Canadian Electric Light Company, of Levis, Que., have orderd a new cable for the transmission of electric power across the St. Lawrence river. The cost will be about $7,000.

Upon reconsideration, the Toronto Board of Control have recommended the awarding of the contract for the new generator and engine for the city hall to the United Electric Company, the lowest tenderer.

On November 18th Mr. C. A. Chant, M.A., Ph.D., of the staff of Toronto University, delivered a lecture before the Astronomical Society on "New Developments in Wireless Telegraphy."

The Lorette Electric Company, of St. Ambroise, Que., is applying for incorporation, with a capital of $50,000, to develop and transmit electric power. The directors include R. A. Oul Shehyn, G. A. Cloutier and Jos. Martel.

It is reported that the Guelph Light & Power Company, of Guelph, Ont., have agreed to accept the city's offer of $155,000 for their electric and gas plants and a by-law may be submitted to the ratepayers to authorize the purchase.

The West Kootenay Power & Light Company, of Rossland, B. C., have offered to furnish electric power for lighting the town of Nelson, B. C., at a cost of $36 per horse power per annum. It is estimated that 350 horse power will be required.

The city council of St. Thomas, Ont., have officially taken over the street railway system and will operate it as a municipal enterprize. It will be necessary to carry out a number of improvements and repairs in order to put the road in good condition.

The electric plant at Cumberland, B. C., was put into operation a few weeks ago. The engine is of 100 h. p. and from the works of the Robb Engineering Company, of Amherst, N. S. The dynamo was supplied by the Canadian General Electric Company.

At a public meeting of the citizens of Moose Jaw, N. W. T., held on November 21, a resolution was passed favoring the construction of systems of waterworks, sewerage and electric lighting. The proposition will likely be made an election issue.

The Founder's Day Exercises in connection with the Thomas S. Clarkson Memorial School of Technology, at Potsdam, New York, took place on Monday evening, the 1st ult. Under the direction of Mr. Wm. S. Aldrich and the Faculty of the College, the occasion proved to be one of unusual interest.

Messrs. S. A. Brodeur, Daniel Dion, J. M. Deschenes, Michael Lefebvre, G. H. Thibault and C. A. Lavimmodiere, all of Valleyfield, Que., are applying for incorporation as the Valleyfield Electric Railway Company, to build and operate an electric railway within the counties of Beauharnois, Huntingdon, and Chateauguay and connecting with Valleyfield and the Canadian Pacific Railway line at Caughnawaga.

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TRADE NOTES.

The Electrical Construction Company, of London, Ont., have secured the contract for an electric light plant for the Globe-Wernicke Company, of Stratford, Ont.

The Toronto & Hamilton Electric Company have installed an electric plant for the Listowel Furniture Company, of Listowel, Ont. It consists of one of their standard multi-polar generators of 6 k. w. capacity compound wound for 110 volts and a Wheelock engine.

The Uuited States Coal Company is about to equip its soft coal mines at Dillonvale, Jefferson County, Ohio, with electrical machinery, and for that purpose recently purchased from the Westinghouse Electric & Mfg. Co. two 150-k.w., 550-volts, direct-current generators and two 10-tons mining locomotives. Electric power will be used for the operation of the locomotives and other mining machinery.

The district office managers of the Westinghouse Electric & Mfg. Company, representing all the principal cities of the United States, spent the week ending November 22 in their usual annual visit to the works and offices of that company at East Pittsburg. On the evening of November 19 a very enjoyable dinner, in honor of the visitors, was given at the Duquesne Club, at which the engineers and executive officers of the company were also present.

The Eugene F. Philips Electrical Works of Montreal, have been awarded the contract for the supply of 170 miles of copper wire required for the transmission system of the Vancouver Power Company. The power house of this company will be located at Coquitlam Lake and the current will be transmitted to Vancouver, New Westminster and other centres. The wire will weigh about 130 tons. It is designated No. 2 gauge and will be one-quarter of an inch in diameter. It will be delivered in three instalments, the last in June, 1903. The contract price is believed to be in the neighborhood of $135,000.

The Chicago Fuse Wire & Manufacturing Company, of Chicago, announce that they have installed at 187 Pratt street, Buffalo, New York, in connection with the Union Manfg. & Specialty Company, a complete equipment for the manufacture of their well known lines of fuse wire, fuse strip, fuse links and telephone and telepraph specialties. This step has been occasioned on account of the steady growth of their business and a desire on the part of the company to do everything in their power to give the best service to their customers in all sections of the country. The headquarters of the company will remain at Chicago, but the eastern factory at Buffalo will be in charge of competent men who are thoroughly trained in the details of the business. Mr. W.R. Goodman, Secretary of the Chicago Fuse Wire & Manfg. Company, further states that their new plans contemplate extensions in their field of work.

SPARKS.

It is proposed to light the Welland canal with electricity, for which purpose 400 lights will be required.

The business of the Orangeville Electric Light & Power Company, Orangeville,Ont., has been purchased by Mr. W. Watson.

The Canadian Niagara Power Company are announced to have just awarded to a firm in Switzerland the contract for three 10,000 horse power turbines.

The Tagona Water & Light Company, of Sault Ste. Marie Ont., have increased their lighting business 50 per cent. during the past year. They are now operating two circuits.

The Ottawa Electric Company are reported to have reduced their rate for lighting from twelve cents net per thousand watts to 9.60 cents. The meter rate is reduced from $3, with 40 per cent. discount off, to $1 net.

Messrs. E. D. Davison & Sons, of Bridgewater, N. S., are reported to have disposed of their timber property and water power in Lunenburg county, Nova Scotia,to a New York syndicate. It is understood that the purchasers will develop the power and erect a pulp mill.

A Hamilton paper states that the Hamilton, Grimsby & Beamsville Electric Railway Company are installing transformers in the the Grimsby car barns and in January next will put in a generating set for the purpose of obtaining the extra power required for the cars on the extension of their line.

Extract from THE CANADIAN ELECTRICAL NEWS, January, 1901, in article describing the plant of the Jacques-Cartier Water Power Company, Qnebec.



* * * Pittsburgh transformers are employed. The transformers have a special winding, the two secondary coils each giving 108 volts, so that a single transformer may feed a three-wire set. They have proved peculiarly free from lightning trouble, as in spite of the severe storms of the past summer, not one breakdown has occurred. Before being put into service each transformer is given an eight hour run at full load, iron and copper losses measured and the ratio tested with a standard transformer. From these tests the percentage regulation is obtained, etc., etc. * * * * * * *

Pittsburgh Transformer Company

Pittsburgh, Pa., U. S. A.

The **R. E. T. Pringle Company,** Limited.

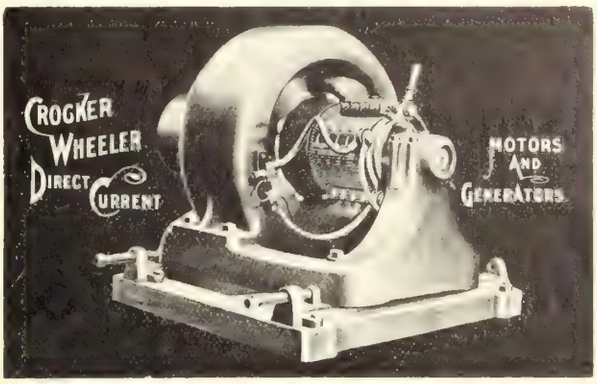
GENERAL SALES AGENTS

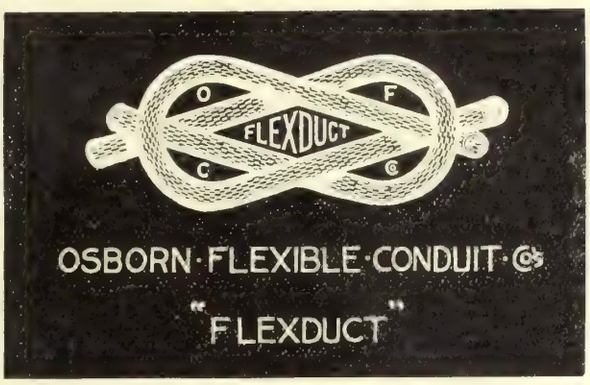
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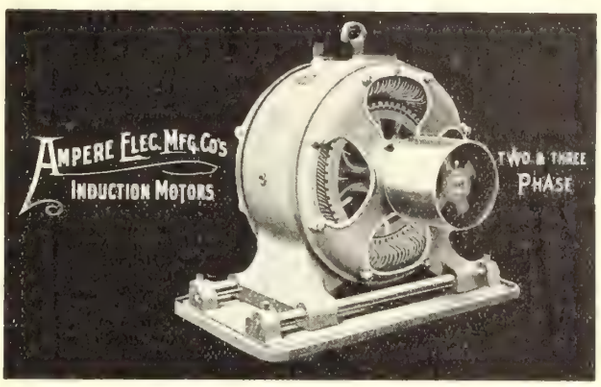
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Montreal.

18 Toronto Street.
Toronto, Ont





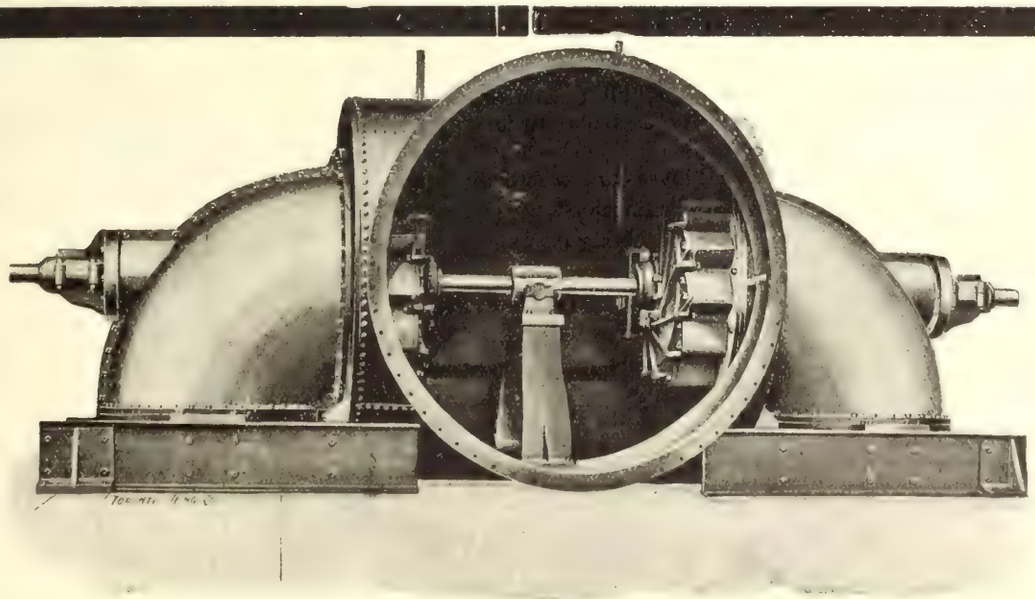




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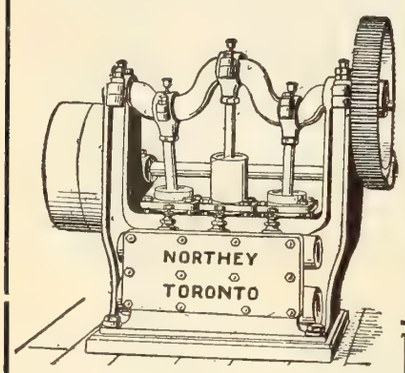
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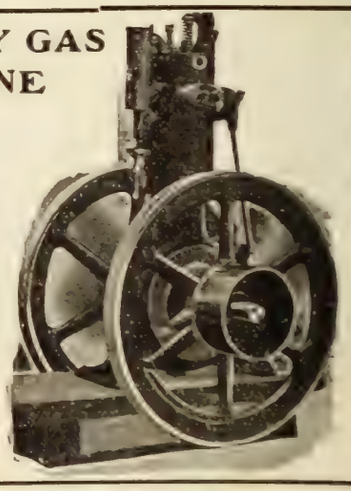


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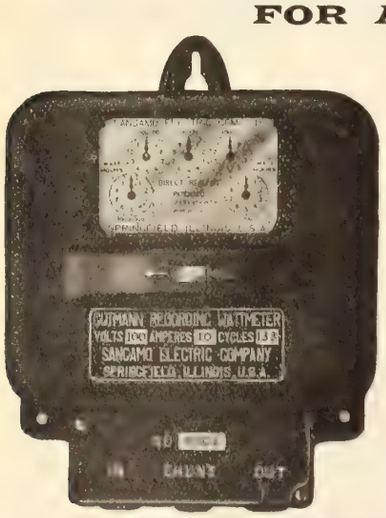
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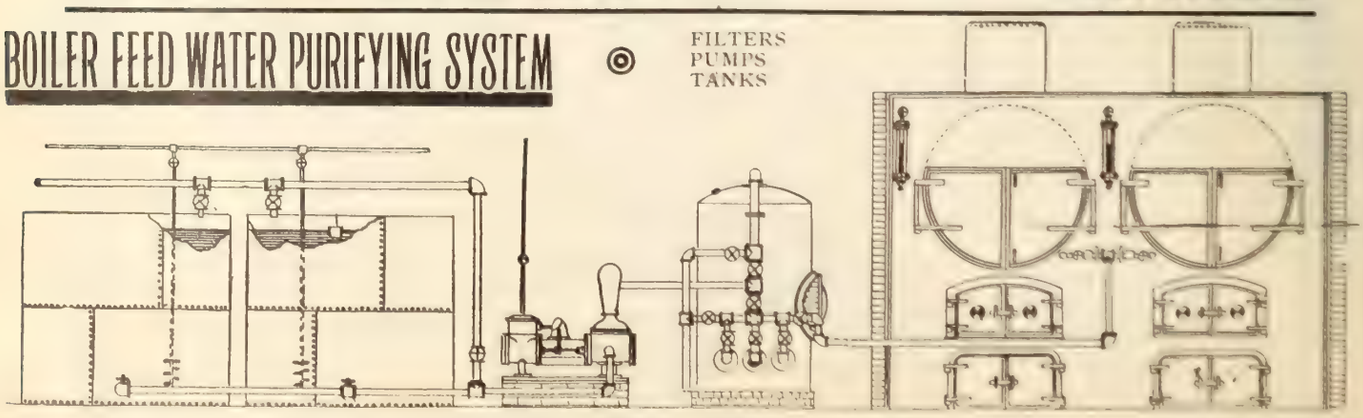


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VOL. XII. DECEMBER, 1902 NO. 12.

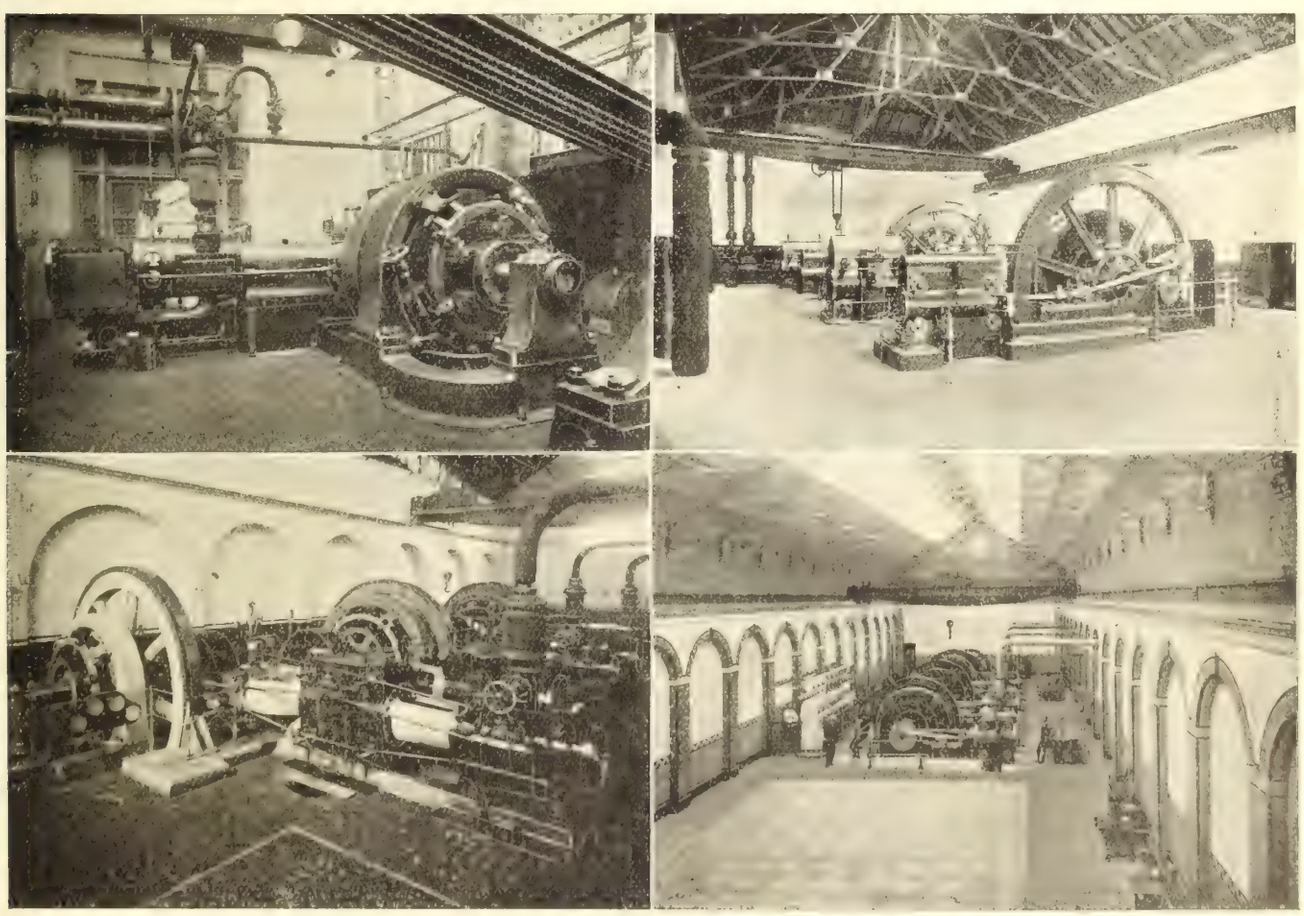
THE LONDON, AYLMER AND NORTH SHORE ELECTRIC RAILWAY.

A company has been organized to undertake the construction of the London, Aylmer and North Shore Electric Railway. This road will be a single track line about forty-five miles in length, running from London to Port Burwell, Ont., through the counties of Middlesex and Elgin. It will pass through one of the finest farming sections in Canada, and there are also numerous factories along the line. The harbor at Port Burwell being one of the finest on Lake Erie, it is expected that the road will secure a large freight business. It is proposed later to put on a line of boats between Port Burwell and Conneaut, Ohio, for coal trade.

The officers of the London, Aylmer and North Shore Electric Railway Company are: President, Mr. E. M. Luton; vice-president and treasurer, Mr. E. Lyon; secretary, Mr. C. R. Luton; assistant secretary, Mr. N. H. Stevens. The engineers are Messrs. Field & Hinchman, of Detroit, who are now engaged on the profile.

The contract for building the road has been awarded to the Aylmer Construction Company, Limited, Majestic Building, Detroit, whose purchasing agent is Mr. F. M. Hitchcock. The company is now engaged in preparing specifications, which will be completed this month, after which the work will be carried to completion as speedily as possible.

It is probable that the building of the power houses and sub-stations will be commenced early in January.



FOUR TYPICAL BRITISH PLANTS—INSTALLED BY MESSRS. DICK, KERR & COMPANY.

MANCHESTER TECHNICAL SCHOOLS.
PORTSMOUTH TRAMWAY POWER HOUSE.
PRESTON POWER HOUSE.
EAST HAM TRAMWAY POWER HOUSE.

The Rapid City Power, Light & Woollen Manufacturing Company has been incorporated at Rapid City, Man. It is proposed to develop a water power on the Little Saskatchewan river. The capital is $25,000.

TRANSMISSION PLANT OF THE OTONABEE POWER COMPANY.

The Trent Valley Canal, which, as our readers are generally aware, is designed ultimately to provide navigable water from Lake Simcoe to Lake Ontario, offers many opportunities throughout its course, especially in that section embracing part of the Otonabee river, extending from Lakefield to Peterboro, for satisfactory water power developments. It is with pleasure that we are able to record the starting of the plant of the first organization in the field, the Otonabee Power Company, which it is confidently predicted will prove to be but the forerunner of many such installations.

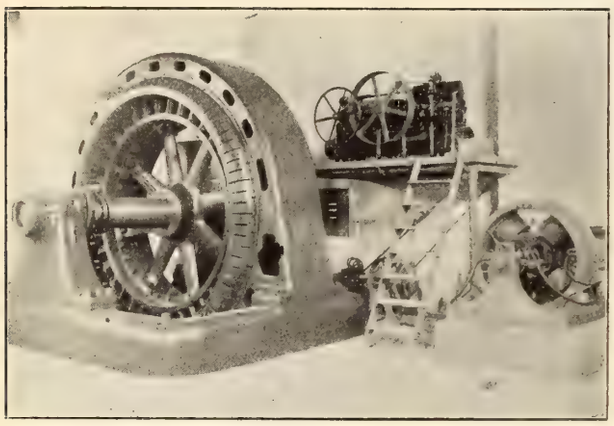


FIG. 1.—GENERATOR, EXCITER AND LOMBARD GOVERNOR.

THE POWER HOUSE.

The power house is situated at what is known as No. 5 dam, in the Lakefield-Peterboro section of the Trent Valley system, on the west bank of the Otonabee river, about five miles directly north of the town of Peterboro. The natural conditions surrounding the site selected enabled a very cheap development, and at the same time one that it is expected will be reliable and economical to operate, in that no great difficulties are expected from frazil, the bugbear of almost all hydraulic plants situated in the colder climates.

The excavations for the wheel setting and the tail race, which were commenced a little over a year ago, necessitated the removal of all the material by blasting, the banks of the river at this point being entirely shale rock, the power house itself, as well as the wing dam extending down stream parallel with the river bank, to form the tail race, and also the concrete, being built with the stone thus obtained. In this connection it is interesting to note that the cement used, which was manufactured by the Lakefield Portland Cement Company, is produced by machines driven by the same water, their power house being situated at Young's Point, ten miles higher up the stream.



FIG. 2.—A 15-TON PIECE EN ROUTE FROM FACTORY TO POWER HOUSE.

HYDRAULIC INSTALLATION.

The hydraulic equipment, which was manufactured and installed by the Wm. Hamilton Company, of Peterboro, consists of three 68 inch Sampson turbines, set vertically, and driving through the usual crown gear arrangement into a horizontal main shaft, to which is connected the generator. Each wheel is set in its own flume, formed by concrete walls running between and provided with means for inserting stop logs for the emptying of the wheel chambers, thus allowing for any inspection and repairs which may be found necessary. On top of these walls are set the I beams, which in turn carry cast iron bridge-trees forming the bearings and thrust collars for the horizontal and vertical shafts. The exciter is driven by its own wheel, a most commendable feature, mounted in substantially the same manner, though it is naturally much smaller, being 23 inches. The head obtained is about 13 feet, under which the main wheels running at 86 r. p. m. each develop 440 horse power. The exciter wheel, running at 255 r. p. m., is rated at 50 h. p., the speed of the horizontal shafts being changed by means of the gear ratio to 200 r. p. m. and 675 r. p. m. respectively. This head can, if necessary, be somewhat increased by means of flushboards, racks for which are provided in the crest of the dam. The equipment also includes the usual straining rack and waste gates.

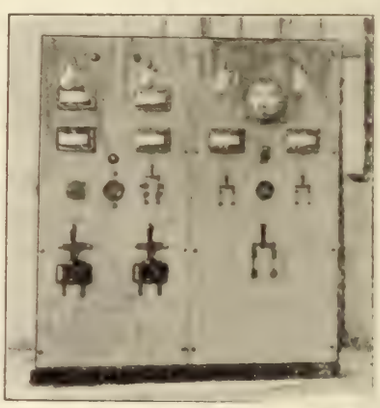


FIG. 3.—GENERATOR SWITCHBOARD.

Above the power house extends a large sheet of still water, formed by a bend in the river, which will minimize the tendency to trouble from anchor ice. A Lombard governor, mounted as shown in Fig. 1, controls the gates of all three main wheels, the exciter being handled entirely by hand.

ELECTRICAL EQUIPMENT.

The electrical equipment of the generating station consists of one 1200 k.w., 60 cycle, 6600 volt, three-phase revolving field generator, operating at 200 revolutions, and one 30 k.w. 125 volt multipolar exciter, both direct driven, as shown in Fig. 1, and controlled by a switchboard of the usual type, equipped with the necessary volt, ampere and watt meters and oil break switches, the front view being shown in Fig. 3. The voltage chosen was selected as being high enough to allow the use of line copper of a reasonable size while still being within the limits of potentials which it is possible to

generate directly in the alternator and thus eliminate the necessity for step-up transformers. Besides it has the further advantage of being the same as that of the Canadian General Electric Company's Nassau station, and thus permits the convenient interchange of power should it ever be found desirable. All the wiring between the machines and the board is carried under the floor, lead covered cable in iron conduits being used.



FIG. 4.—TRANSFORMERS IN SUB-STATION.

From the switchboard to the lines it runs in the open up the face of the wall. The lightning arresters, each of which is provided with a cut-off switch for cleaning and inspection, are also mounted on this wall, being connected to the lines at the point where they enter the building. Ordinary heavy porcelain tubes are used for this latter work, the wire being heavily rubber covered to a point distant some few feet from the outside walls, where they join the bare line wire. The power house is designed to accommodate another machine, which it is confidently expected will soon be required. Accommodation is also provided for a crane which is not yet installed. The electrical apparatus was furnished and installed by the Canadian General Electric Company.

THE POLE LINE.

The line, which consists of two circuits, mounted on one set of poles, leaves the power house on the north, and immediately turns east to cross the river, from whence it goes generally south along the right of way of the Lakefield branch of the Grand Trunk Railway, a most suitable and convenient route, free as it naturally is from anything but very small grades, and affording, through the medium of a hand car, means for quick and easy patrol. Each circuit consists of three No. 2 copper wires mounted on No. 2 Imperial porcelain insulators, spaced equilaterally, the base on top, a somewhat unusual arrangement, and protected in addition to the lightning arresters at each end, by a barb wire strung on top pins and standard glass insulators, and grounded at every fifth pole to an iron plate placed under the butt.

These power circuits are not transposed, modern practice not requiring it unless in the case of long lines of high capacity whose load consists largely of lighting, and where very close voltage regulation is necessary.

Underneath the main circuits, mounted on the standard pins and cross arms, are the two telephone lines, of No. 10 iron wire, which connect the power house, sub-station, office and manager's residence. They are transposed every five poles to prevent disturbance from the power lines overhead. The method of entrance into the substation is identical with that adopted for the exit from the power house, the wiring until it reaches the switchboards all being overhead. A similar lightning arrester equipment is also installed here.

THE SUB-STATION.

The sub-station, which is of brick, 22 x 35 feet, is situated on the river bank at the corner of Simcoe and Water streets, about in the centre of the town of Peterboro, and approximately equidistant from the various factories which it will supply with power. The equipment consists of transformer and feeder switchboards and six 250 k.w. air blast transformers of the standard Canadian General Electric type, supplied with the necessary cooling air by means of a fan driven by a two h.p. induction motor. The general arrangement of the blower and motor and part of the transformers can be seen from Figure 4, from which it will be noted that, differing from the usual arrangement of air blast transformers, whereby they are mounted on a raised platform to form the necessary air chamber, this latter is obtained by means of excavating under the floor level, which, besides improving the appearance of the room, makes it much easier to install the apparatus.

The chamber under the transformers is about 18x12 and 4½ feet deep, a convenient size for inspection and cleaning, a trap door being provided for entrance. This chamber, besides carrying the air from the blower to the various transformers, serves also for the wiring, which is run in conduits from the switchboard to the underside of the transformers, up through the air opening to the low potential connection board, which is on the bottom, and through a pipe, shown in Fig. 4, to the high potential connections, which are on the top of the transformers.

The switchboard, equipped with the standard set of instruments which is usually provided for work of this class, controls the transformers, the two incoming lines and the outgoing feeders, making various combinations between them, by means of oil break switches. The only special feature is the use of switches which enable any transformer to be instantly cut in or cut

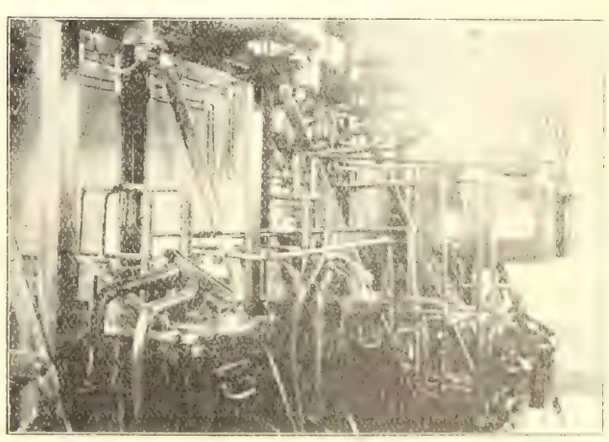


FIG. 5.—REAR OF SWITCHBOARD, SHOWING CONNECTIONS TO OIL BREAK SWITCHES IN SUB-STATION.

out of service, the changes being made without interruption to any part of the system.

The principal consumers of the power generated by the Otonabee Power Company will be the Cordage Company, which has already installed some four hundred horse power in motors, the Wm. Hamilton Company, the Matthews Packing Company, the Ultimator Sifter Company in Ashburnham, just across

the river, the Hicks Mfg. Company, W. H. Meldrum's elevator and the Colonial Typewriter Company. Doubtless the present plant will soon be loaded to its full capacity, as the town of Peterborough, which is to be congratulated on its list of manufacturers, both existing and prospective, is growing very rapidly and well maintaining its position as one of the premier towns of Canada.

The officers of the company are: Wm. Ferguson, manager Kingston Hardware Company, president; W. A. Stratton, solicitor, first vice-president; Adam Hall, president of the Canadian Cordage Company, 2nd vice-president; R. R. Hall, treasurer; W. H. Meldrum, managing director. The harnessing of this magnificent water power has been carried out under the direction and personal supervision of Mr. Meldrum, who may feel justly proud of the successful installation of this splendid plant, all his efforts being fully sustained by every member of the directorate.

As advised above, the entire work was carried out by local contractors, the hydraulic installation by the Wm. Hamilton Company and the electrical installation by the Canadian General Electric Company. The buildings were designed by Mr. John E. Belcher.

INSULATORS FOR LONG DISTANCE POWER TRANSMISSION.

The following abstract relating to insulators for electric power transmission lines is taken from an interesting paper on the problems and difficulties of the transmission of power long distances, read by Dr. F. A. C. Perrine before the Massachusetts Institute of Technology and printed in the "Technology Quarterly."

For potentials up to about 25,000 volts, where an insulator of 7-inch diameter is sufficient, there seems not much reason for the employment of anything except glass, unless the lines reach a size above half an inch in diameter, when its strength is deficient. For these lower potentials and lighter lines the good properties of glass are easily summarized. In the first place, it is cheaper by far; while not so strong as porcelain, it is, as has already been said, sufficiently strong for the purpose; its inspection is easier and surer, since it requires only a visual examination and a few taps of a hammer to acertain its soundness in place of the tedious high potential test necessary in the examination of porcelain. But having said this much, all has been said that is possible in favor of glass.

It is not true that glass is a better insulator than sound porcelain, nor is its surface so good in damp weather against surface leakage. The mechanical strength does not equal one-half that of porcelain, as has been proved by a long series of mechanical tests performed by dropping a steel ball from a height upon insulators of the two materials; temperature also affects it much more than porcelain and it is often found to crack simply from the effect of extreme changes of temperature.

The insulators for high voltage lines must be very lnrge, for the reason that with a striking distance through the air of from 4 to 6 inches, great gaps must be provided in the path of the current. But above all a great creeping distance is essential. Insulators that are a perfect protection in the hardest rains fail utterly in clear weather when covered by smoke and soot, which allow small amounts of currents to escape and char away the pins or cross-arms. The compound insulator is very attractive, for the reason that it is easier and cheaper to make and handle two or three small parts rather than one large one, and in some cases the additional advantage has been sought of securing the good properties of both glass and porcelain by making parts of an insulator of each; but there is both a theoretical and practical fallacy in this type of design. In the first place, no dielectric is so strong as one entirely homogeneous. As the stress is passed from glass to porcelain, or vice versa, at the two surfaces the stress piles up as it were, and it is better if one believes in glass to rely upon it; or, on the other hand, to show faith in the porcelain used by employing it entirely.

From the pure standpoint of practice the insulator which must be cemented together is troublesome. The shrinking of the mastic leaves voids and produces strains; if cement be used, its slowness in hardening delays the work and requires large areas for setting out to harden any considerable number of insulators. The one other mastic in use is molten sulphur, which, while better as a mastic than cement, is still more liable to crack the insulators while they are being joined, and finally when exposed to light and air, frequently decomposes on the surface, producing sulphuric acid; and, finally, when current creeps over its surface following the acid, perhaps cathes fire and often results in the rupture and fall of the insulator. The insulator which will be entirely satisfactory for this use has not yet been found, but the diligent search made for it by some of our best engineers is resulting in its definition and will probably soon result in its production, not as an inspiration for a patent, but as a careful engineering conception.

THE CURRENT REQUIRED BY ELECTRIC MOTORS.

A recent number of Science and Industry, published at Scranton, Pa., contains as a supplement a table showing the current taken, at full load, by various sizes of electric motors of both direct and alternating current types, at the ordinary pressures of 110, 220 and 500 volts.

The ampere consumption of direct current motors depends directly upon the efficiency of the motor, and with alternating current motors it depends upon both the efficiency and the power factor of the motor. These qualities vary somewhat in motors of different make, so the values given in the table herewith may be considered as fair, rather than exact, averages. They are useful in making wiring calculations, fusing, etc. The current given for two-phase motors is the full load current of each phase; the current for the three-phase motors is the current in each of the three wires leading to the motor.

H. P.	Direct Current Motors			Alternating Current Motors								
				Single-Phase			Two-Phase (4 Wire)			Three-Phase (3 Wire)		
	110 v.	220 v.	500 v.	110 v.	220 v.	500 v.	110 v.	220 v.	500 v.	110 v.	220 v.	500 v.
1	9	4.5	2.0	14	7	3.1	8.4	4	1.4	7.4	3.7	1.6
2	17	8.5	3.7	24	12	5.3	11	5.5	2.5	11	5.5	2.5
3	26	13	5.6	34	17	7.5	16	8	3.5	14	7	3.3
5	40	20	8.8	52	26	11	25	13	5.8	22	11	5.1
7½	60	30	13	74	37	16	35	18	8	31	16	7.4
10	76	38	17	94	47	21	44	22	10	39	20	9.2
15	112	56	25				66	33	15	58	29	13
20	150	75	33				88	44	20	77	38	18
30	226	113	50				134	67	30	114	57	26
40	302	151	66				178	89	41	154	77	35
50	368	184	81				204	112	52	177	88	41
75	552	276	122				338	154	69	292	146	67
100	736	368	162				445	204	96	385	192	89
150	1110	555	244				670	308	145	580	290	134
200	1474	737	324				918	418	196	795	397	184

THE SLEEPER PATENT STEAM ENGINE.

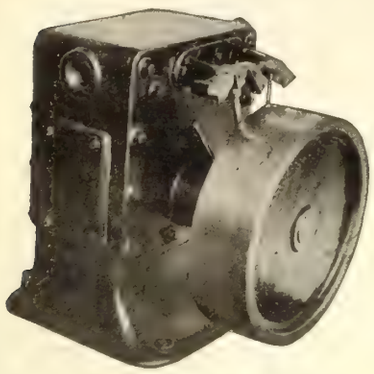


FIG. 1.—EXTERIOR VIEW OF 12 B.H.P. SIMPLE, SINGLE-ACTING ENGINE.

A steam engine with many new and, one might almost say, many revolutionary features has recently been placed upon the market by the Sleeper Engine Company Limited, of Montreal. It is in its entirety a Canadian invention, and since the first patent was applied for, now some two years since, it has been financed and backed by Canadian capital. As might be inferred, it takes its name from the inventor, Mr. Frank H. Sleeper, formerly of Coaticooke, but for many years a resident of Montreal. Mr. Sleeper is well known for his inventions in special and electrical machinery and wire machines, as also for the lifting jacks which are now in universal use on this continent, and his many friends will be glad to know that the success which has attended so many of his inventions in the past—a success which has been due as much to a correct appreciation of machanical principles as to boldness and originality of design,—has followed also in the case of the Sleeper steam engine.

Considered either externally or internally, these engines present an altogether different appearance to the ordinary reciprocating engine. Externally, there is no extended frame with massive base and heavy bearings, nor does it show the familiar cylinder, piston, slides and crosshead. Instead, there is seen a circular or rectangular cast-iron casing, in which all of the working parts are enclosed. Its first advantage, that of exceeding smallness and compactness, is thus disclosed. This elimination of metal and size has not in any way, so far as can be ascertained, impaired its strength, wearing power, or its ability to "stand up" under a heavy load.

Coming now to a consideration of the internal arrangement, or rather, to the actual working parts, it will be clearly seen from the illustrations that the old cylinder-and-piston form of design

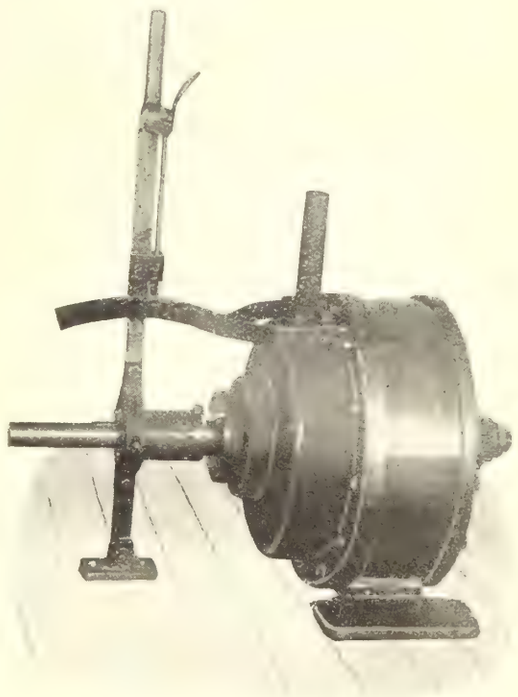


FIG. 2.— EXTERIOR VIEW OF 5 H. P. MARINE ENGINE.

has been abandoned, and that the expansion chamber is composed of a flexible wall, made up of two parts connected by a link. The hinges of the parts of this flexible wall are provided throughout with roller bearings. The flexible wall is attached to the crank-shaft by a connecting rod, and the outward movement of the wall, when steam is admitted to the chamber, actuates the crank-shaft.

In the last analysis, when one is really forced to make a definition, the Sleeper engine cannot be said to be any other than a reciprocating engine, though several mechanical experts have called it a semi-rotary engine. This makes it a very difficult matter, when dealing descriptively with an engine of this kind, to institute comparisons, since it is in a class by itself, being a connecting link, as it were, between the reciprocating and the rotary engines. From the design it will be seen that that form of construction which has figured so much in rotary engines, namely, an internal cylinder revolving eccentrically within another cylinder, or carrying sliding, projecting wings in contact with the internal wall of the outer cylinder, has been altogether avoided. What has really happened in a manner is that the enormous side-thrust which was the defect in these machines has been practically utilized to drive the Sleeper engine. The great leakage which put so many of these engines out of the range of practical usefulness has been reduced in the Sleeper engine to a factor of little importance. It is conceded that it has been these two factors, i. e., friction of internal parts which could not be obviated, and leakage of steam by and between surfaces which it was impossible to pack steamtight, which has hitherto kept engines designed for very high speeds, with great compactness of size and weight, out of the market.

In the engines of the circular type, used for high-speed, direct-connected electric lighting and marine work, connecting rods are not used to connect the flexible wall of the expansion chamber and the crank-shaft. Instead, a crank eccentric is provided, and upon it the flexible walls bear by means of rollers one after the other, as steam is admitted to the chambers consecutively.

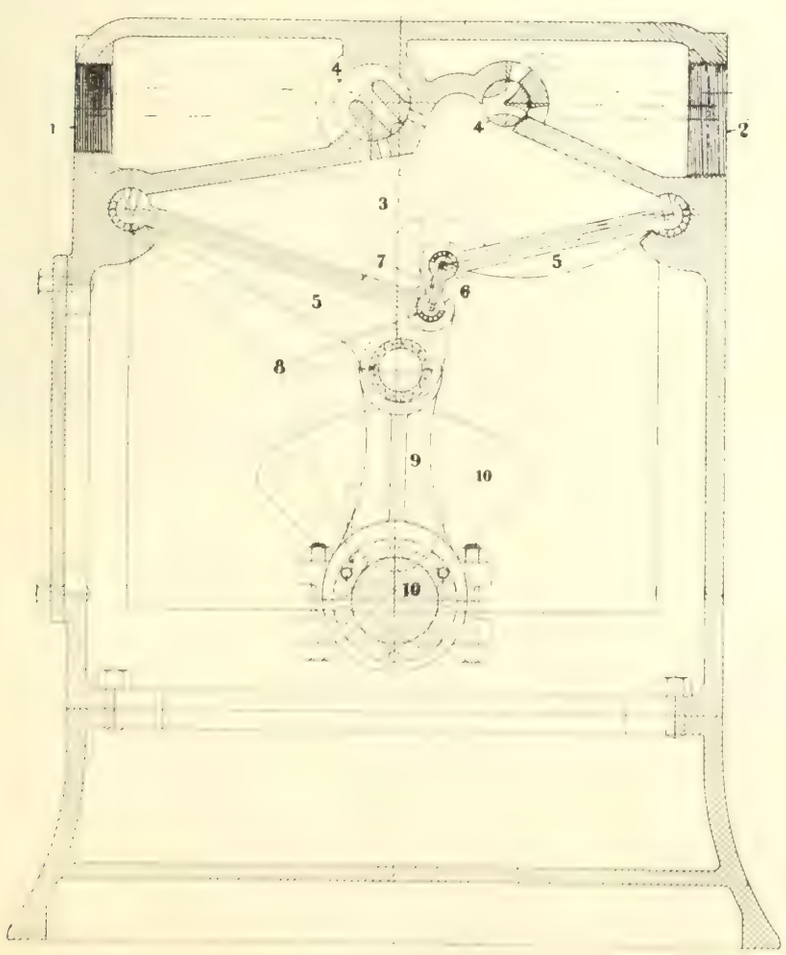


FIG. 3. SECTIONAL ELEVATION OF SIMPLE, SINGLE ACTING ENGINE ON BASE.
1. Steam inlet. 2. Exhaust outlet 3. Expansion chamber. 4 and 4. Valves. 5 and 5 Parts of flexible wall of chamber. 6. Link connecting parts. 7. Packing strips. 8. Roller bearings. 9. Connecting-rod. 10. Crankshaft.

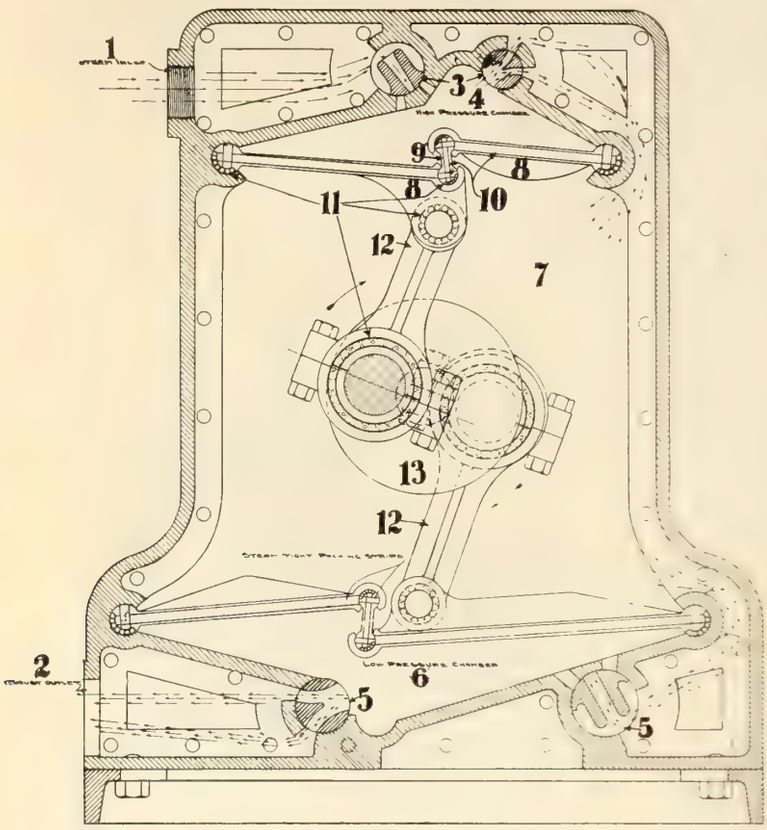


FIG. 4.—SECTIONAL ELEVATION OF 25 H.P. COMPOUND ENGINE.

1. Steam inlet into high pressure chamber. 2. Exhaust from low pressure chamber. 3. Inlet and exhaust valves for high pressure chamber. 4. High pressure chamber. 5. Inlet and exhaust valves for low pressure chamber. 6 Low pressure chamber. 7. Engine body used for steam reservoir. 8. Parts of flexible wall for high pressure chamber. 9. Link connecting parts. 10. Steam tight packing strips. 11. Roller bearings. 12. Connecting rods. 13. Crankshaft.

On the stationary engines of the rectangular type, valves of the Corliss variety are used, with a modification as to the valve gear. On the other hand, a valve of an entirely new design is used on the engines of the circular type. This may be studied in Fig. 6. It is a balanced slide-valve, operated by an eccentric upon the shaft, and guided in straight lines across the steam inlet port openings by an arrangement of elliptical ring and links.

A close study of the sectional elevations and interior views shown in Figs. 3, 4 and 5 will show the great care that has been taken with regard to the bearings of these engines. In all cases the pins, shafts, and other rotative parts, the rollers themselves, and the outer sleeves or shells in which the bearing cages revolve, are of steel, hardened and ground. The cages are of an advanced design which has for its primary object the ensuring of an absolute parallelism between the shaft and rollers, preventing effectually the binding and twisting tendencies which nullify the use of many roller bearings.

Leakage of steam from the chambers is prevented by a system of packing strips which take up wear automatically, and require no attention or care whatever.

Some of the most interesting features about the Sleeper engines, and those to which the manufacturers direct attention especially, after the expansion chamber and the valve motions and gear, is the reversing gear on the marine and automobile engines. It is operated with one movement of the reversing lever, without special gearing, and is instantaneous. Another feature is the absence of vibration, "knocking," "slack," and the inertia movement in starting and stopping. Again, by the structure of these engines they are specially adapted for use with superheated steam at high pressures, being in accordance with the most advanced steam-engineering practice. But the features which the manufacturers lay even greater stress upon, and to which they are now directing the attention of the engineering profession, are of much more importance than even these. We refer to the steam economy which several series of tests in McGill University Laboratory has distinctly proven to be very great, and to the very high speeds attained by all types of these engines.

The tests were made upon simple and compound engines of the type shown in Fig. 1, and further illustrated by sectional views in Figs. 3 and 4, and collected into brief form are as follows :

TESTS OF 12 B. H. P. SIMPLE, SINGLE-ACTING ENGINE.

Trial No.	Brake H. P.	R. P. M.	Steam used per B.H.P. per hr.	Steam Pressure.	Load.	Brit. Units per B H P.
1	5.63	650	[illegible] lbs	44	1/3	[illegible]
2	10.2	725	[illegible] "	84	2/3	[illegible]
3	13.1	775	36.4 "	84	Full.	590

The report further states : "Variations in speed between 650 R. P. M. and 725 R. P. M. made very little difference in the economy." And again : "This is an exceptionally good result for a single-acting engine, and I believe it has never been equalled by any single-cylinder engine of this small size."

It was a natural expectation that if such remarkable economy was attained by a simple engine, much greater efficiency would be attained by engines of the compound order. How far this expectation has been met by the results obtained may be judged

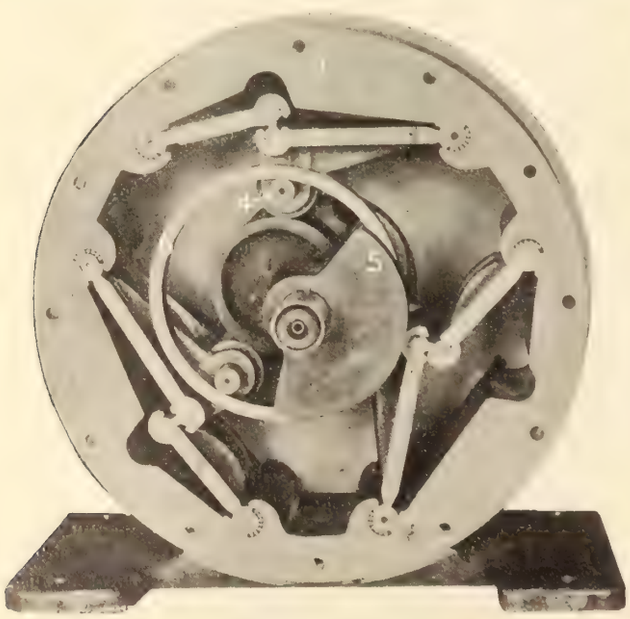


FIG. 5.—INTERIOR VIEW OF MARINE ENGINE.

1. Frame. 2. Parts of the flexible wall of expansion chamber. 3. Link connecting parts. 4. Roller bearings on crank eccentric. 5 Crank eccentric. 6. Retaining ring.

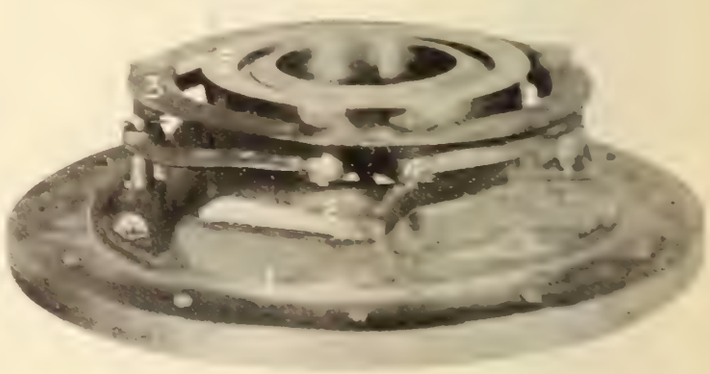


FIG. 6.—VALVE MOTION.

1. Valve seat 2 Valve 3 Elliptic parallel ring 4 Links 5 Relief ring.

In this view the valve motion is shown detached from the engine body. The line of contact between the seat and valve may be plainly seen. The motion imparted to the valve by the eccentric is circular, and the ring and links are used to change or guide it into such a motion that the valve moves across the port opening in straight lines. The parallel ring being elliptic the valve is free to move inside of it in one direction, guided by links fastened at one end to the valve and at the other to the ring. Both ring and valve will also move together at right angles to the first direction, this movement being also guided by other links fastened at one end to the seat, and at the other to the ring. The manner of securing links may be plainly seen.

from the figures following, taken in advance from an official report of the McGill University Laboratory.

TESTS OF 25 B. H. P. COMPOUND, DOUBLE-ACTING ENGINE.

Steam Pressure Gauge.	Load B.H.P.	Steam Consumed per B.H.P. per hour.	Vacuum equal to
106 lbs.	23	25.3 lbs.	24.6 inches of mercury.
62 lbs.	14	28.6 lbs.	22.5 inches of mercury.

The following are selected from among a number of private trials made by Mr. Frank H. Sleeper:

25 B. H. P. COMPOUND ENGINE.

Trial No.	Steam H.P.	Steam Int.	Vacuum.	Cut-off H.P.	Cut-off L.P.	R.P.M.	Load B.H.P.	Steam used per B.H.P. per hour.
1	52 lbs.	5 lbs.	22 in.	—	—	714	16.4	26.5 lbs.
8	85 lbs.	12½ lbs.	22 in.	¾	¾	600	25.25	26.75 lbs.
9	———	———	22 in.	¾	¾	333	12.75	26. lbs.

A curious and yet important feature of these engines, which is

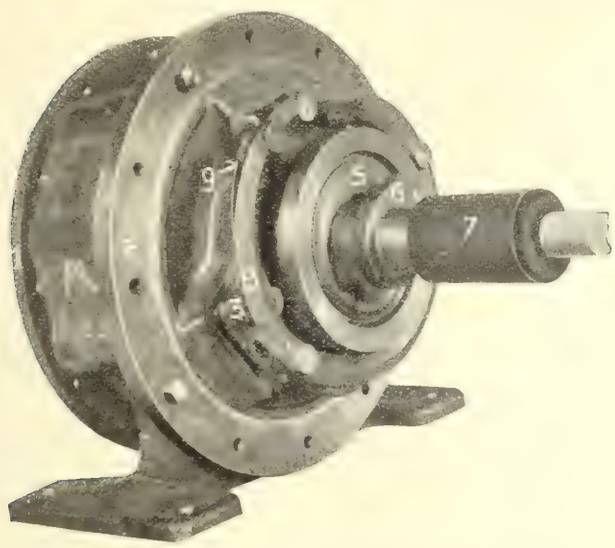


FIG. 7.—MARINE ENGINE, WITH STEAM-CHEST COVER REMOVED, SHOWING VALVE MOTION, WITH LOWER LEFT-HAND STEAM-PORT OPEN.

1. Engine frame. 2. Valve seat. 3. Valve. 4. Relief ring. 5. Eccentric. 6. Inner reversing sleeve. 7. Outer reversing sleeve.

shown by such tests as the above, is that very little difference is made in the efficiency whether running at half or full speed.

Despite the very high speeds at which the compound engine referred to was run, the Professor in charge of the Laboratory managed by means of an ingenious arrangement to take off some indicator cards, and some of these we hope very soon to present to the readers of the ELECTRICAL NEWS. We will inform them in advance that the cards have an ideal form, and accord so closely to the perfect card that there is apparently no leakage whatever in the engine.

With reference to the other point, i.e., that of high speed, there is much more in it than is usually thought, and this is a point which such a discussion as the foregoing brings up clearly.

One of the principal losses in a steam engine is that due to condensation on the cylinder walls. In the best engines such a loss may be only 25 per cent., while in the worst types it may be as much as 70 per cent. By practical experiment it has been found that increasing the speed of the engine has the effect of decreasing this loss. In an engine running at 400 r. p. m. the loss is but one-quarter of that in one running at 120 r.p.m. Consequently, leaving friction aside, the higher the speed the greater the economy, and at 1000 r. p. m. the loss from this cause would be nil. The leakage of steam past valve and piston is another and serious loss which is minimized by high speeds. Let us suppose, for example, that an engine running at 100 r.p.m. leaks steam in this way to the extent of 50 per cent. of its useful supply. Now, let the speed be increased to 1000 r. p. m., while the steam pressure remains the same. It will be seen at once that the leakage per hour has not been increased, while the power has been increased tenfold, reducing the leakage from 50 to 5 per cent.

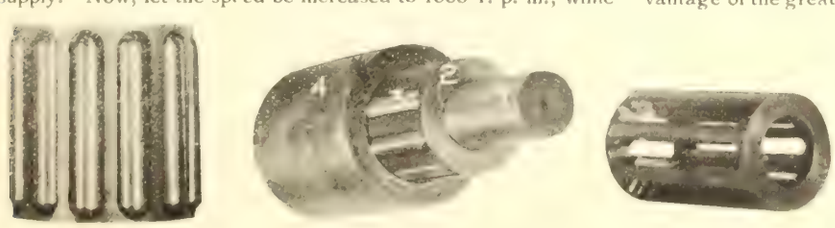


FIG. 8.—ROLLER BEARINGS.

1. Pin or shaft. 2. Cage for rollers. 3. Rollers. 4. Outer sleeve.

The secret of the high efficiency of the Sleeper engine is claimed by the inventor to lie in the reduction of friction and weight of the working parts to such an extent as to permit of very high speeds being attained without danger, as is evidenced by the lack of noise and vibration, lessening leakages and condensations, and tending constantly to greater and greater efficiency.

The working parts, besides being in mechanical balance, are, by comparison, very small and light; this materially assists in the diminishing of noise and vibration. Even when running as high as 2500 r.p.m. stability is a marked feature of these engines. On engines of the circular type, a flywheel is unnecessary. These engines are used for marine and automobile service. The

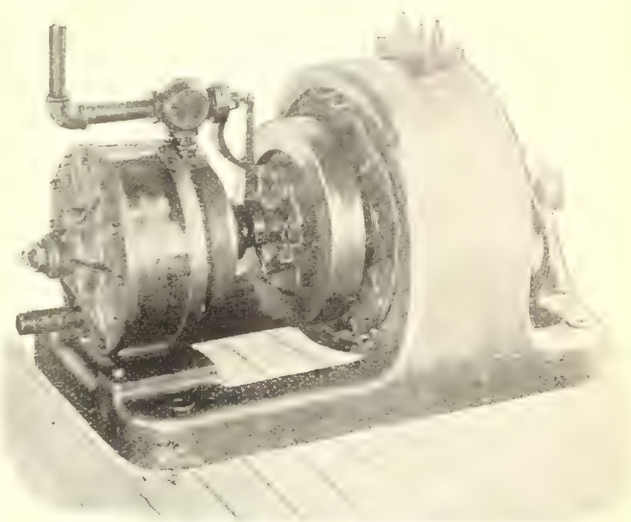


FIG. 9.—3½ KILOWATT, DIRECT CURRENT, MULTIPOLAR, SLEEPER GENERATOR, DIRECT-CONNECTED TO THROTTLE-GOVERNED SLEEPER ENGINE ON SAME BASE. R.P.M. 1000. BASE DIMENSIONS, 18 IN. X 31 IN. WEIGHT, COMPLETE, 600 POUNDS.

weights of the frame and moving parts are well distributed and all bearing surfaces are generously proportioned.

Referring especially to automobile work, an engine which the inventor claims to be perfect has been designed especially for such service.

It is dust-proof, fool-proof, weighs but fifty pounds in a 6 h.p. size, is economical of steam, simply and perfectly lubricated, reverses instantly and without special gearing, of rapid control in every particular, without vibration and without flywheel, and operates with superheated steam at high pressures.

The use of engines of the Sleeper type generally throughout the ship-building countries will be certain in the end to effect modification in marine architecture of the most far-reaching kind, and will tend in many ways to important economies of every kind in general cost and maintenance.

In this connection it is interesting to know that the Sleeper Engine Company has had an exhibition steam-launch in the vicinity of Montreal all the past season, operating under circumstances of unusual interest. The combination consisted of an engine of the Sleeper marine type, connected to an automobile coil boiler, of the latest quick-steaming, semi-flash, non-explosive kind. Liquid fuel was used, it being forced into the vaporizer under a heavy air pressure. Here we have the three requisites for the perfect power unit of the future—i.e., fuel in a cheap, convenient form, capable of generating intense heat very quickly and of being regulated automatically by the steam pressure in the boiler; a non-explosive, water-tube boiler capable of generating 250 pounds of steam in five minutes, light, compact, safe, and reliable; and an engine of exceptional steam economy, running at very high speeds, reversing instantly, and without noise or vibration.

The high speeds which make these engines so valuable in other lines will be seen at once to be of incalculable value in electrical work, and the service rendered so far has been unmistakably towards a still greater economy in electric lighting and general power. The high speeds enable one to take advantage of the greater efficiency of generators when run fast, and enables at the very least double the power to be laid down in the same station plant space as compared with slow speed units, while the parts are not nearly so cumbersome and massive, and may be much more readily handled and moved about the station. The great reductions effected in the size and weight of the engines themselves places them at a great advantage in one respect, i. e., that unlike all other units, in which the generator may be said to be placed upon an extension of the engine base, with the Sleeper engine, and that too despite the much higher speeds—the positions are reversed, and the engine is placed upon an extension of the generator base. Nothing else will give such a vivid idea of the compactness and small-floor-space dimensions of hese engines. In operation the direct connected units are auotmatic, the valve being set at the most economical point of cut-off, and the engine being throttle-governed. With such an automatic control the lights are free from fluctuation, the speed being positively maintained.

G. D. HARTLEY.

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The Chambly Plant.

A newspaper dispatch of November 30th conveyed the information that a portion of the dam of the Chambly Manufacturing Company at Chambly, Quebec, had on that day been carried away. It is understood to be the intention to build a new coffer-dam, which will probably be completed within a month. Since its inauguration, less than five years ago, this plant has been particularly unfortunate. This is the second time that the dam has broken away; the original water wheels have been replaced by others of different type; the generators have been rewound; and material changes have been made in the switchboard. In the construction of the plant engineering advice of a high standard was secured, but notwithstanding this and other precautions the changes to which we refer were found advisable. These circumstances indicate that as a rule water power is not as reliable as steam.

Canada's Development.

CANADA has entered on a period of development which seems likely to rival that of the United States. Almost every day brings news of some colossal enterprise, and we are becoming so accustomed to such announcements that as a rule we receive them with but very moderate surprise. The declaration however by the authorities of the Grand Trunk Railway Company of their purpose to begin immediately the construction of a line by way of the Peace River Valley to the Pacific Coast, has naturally awakened the deepest interest from one end of the country to the other. The announcement is a declaration of confidence in the future of our great northwest territory that must greatly redound to the benefit of this country. The expenditure of something like $100,000,000 in the construction of the new transcontinental line will help to extend and maintain for some time to come the prosperous conditions which now prevail, while the inflow of population following the opening up of a vast and fertile territory, will permanently broaden the market for manufactured products. The future greatness of Canada seems now to be assured and considering the rapid movement of events in these days, another decade will probably witness its realization.

The Recent Street Railway Convention.

THE amenities of modern business life and relaxation from its strict routine and discipline are few and far between. It was therefore with great pleasure that we were able to publish last month the names of most of our larger street railway companies as among the number of those who saw fit to give various of their departmental heads the opportunity which was afforded by the recent Detroit meeting of the American Street Railway Association to meet those who have duties and responsibilities much the same as their own, and to inspect and become more or less familiar with the latest developments and specialties in modern electric railway practice. No man who is for ever confined to the routine and methods of his own particular company can be expected to produce results as good as he might be capable of were he given the opportunity to rub against other men and their ideas. We look for great benefits from the visits of the various delegates—not only from the introduction of new apparatus or methods which those concern d

may decide to be beneficial to their respective companies, but also from the closer and more permanent relations induced between the companies and their employees ; it is to be hoped that the example which has been set will be followed to an increasing extent each year. By the way, it was an open secret during the progress of the meeting that difficulty was being experienced in selecting a meeting place for next year, in view of which an invitation from Toronto would doubtless be acceptable. No one can doubt but that if the convention were to come here the benefit derived therefrom would be large, not only by the city itself but also by the country at large.

Fire Risks.

A correspondent forwards to the Insurance and Finance Chronicle, Montreal, the following extract from an insurance book published in 1895 :

"Friction of machinery is one of the most common causes of fire, especially at night. The shaft heats from the centre, and the heat may increase and spread after the machinery has stopped."

The correspondent states that while fully agreeing with the first part of the above statement he is skeptical as to the latter, and asks for proof or disproof thereof. As it does not seem meet that apparently erroneous statements, which concern apparatus handled by a large portion of our subscribers, should go uncorrected, we would state what we consider the correct view of the case. The heating of a shaft does not take place from the centre, but from the outside, the point where the friction against the bearing, which is the source of the heat, exists, though the centre may get hotter, ultimately, than the outside. If, when matters were in this condition, both as regards the bearing as well as the shaft, the machinery were stopped, the radiation will be much less because the surrounding air is now still, consequently the heat stored up in the interior may by convection increase the heat of the exterior to a point above that at which it was when in motion, but neither the total heat, nor the temperature of the hottest part, can possibly increase after the apparatus has been brought to rest, and therefore the source of the heat, namely, the friction of the journal against its bearings, is entirely eliminated. The case is similar to that of a motor or dynamo, in which the heat of certain parts, such as the ends of the windings outside the poles, the outside surface of the armature and commutator connections, may rise materially as soon as shut down, due to the fact of the radiation being greatly reduced because it is not now moving rapidly through the air ; the heat from the inside of the windings and commutator bars tends to spread and equalize through all parts, though both the total heat and the temperature of the hottest part begin to fall the instant the apparatus is shut down, and thus the flow of current and magnetism, the sources of the heat, are stopped.

A Large Switchboard.

THE Clergue power plant on the American side of the Soo, which was opened with much eclat not long ago, though second only to Niagara in its total capacity, which is about 45,000 horse power, possesses no very special features in the lay-out of the generators, which, 80 in number, part Westinghouse and part Stanley, are all of the revolving field type, and rated at 400 k.w. each, though when we come to look over the switchboard controlling it we find many new and most interesting devices. In the first place, there had to be faced the problem of arranging a board which would be practicable as far as length was concerned, as if made according to standard practice it would have extended to nearly 300 feet, and so it was finally decided that it should be built in three sections arranged so as to form three sides of a 12 foot square, these small dimensions being rendered possible by making each generator panel but six inches wide, and by mounting above them those for the feeders, which are half as many in number. The control of all the different parts of the equipment is that known as the pilot system, whereby none of the main circuits are themselves brought to the board, which consequently contains only shunt-circuit instruments and small switches for controlling the relays which operate through solenoids the main switches. Any failure of the energizing current in these relays results in the instantaneous opening of all those main switches which it controls, this action being similar to the safety principle of the block system of signals for railways, where any interruption either from a short or open circuit immediately sets all the semaphores to danger. This controlling equipment comprises not only that necessary for the handling of the generators and feeders, but also for that of the wheels, which can be started and stopped, speeded up or slowed down, by means of switches provided on the generator panels. In this connection it is interesting to note that the water-wheel governors, which are of the Lombard type, instead of being equipped each with its own pump, as is the usual practice, are supplied on what might be called the central energy system from one common pressure reservoir. Owing to the narrowness of the panels the generator meters are all very close together, and naturally being at the same level, their needles, when all are carrying their proper share of the load, form almost a straight line round the board. Any variation from normal, as indicated by some one pointer being out of the line, is therefore at once noticeable, and the work of correcting the difficulty which it indicates, owing to the control of the wheels as well as of the generators being on the same panel, takes practically no time. In addition to the above special features the board possesses the usual equipment of double bus-bars, switch indicating lamps, bus-bar coupling switches, etc., and will doubtless give a good account of itself in the somewhat difficult task which it has before it.

ELECTRICAL MACHINERY.

Orders have been placed by the authorities of Queen's College, Kingston, with seven or eight Canadian firms for some very intricate electrical equipment for the new Engineering Building. In the study of electrical and mechanical engineering, a great many generators, transmitters, various kinds of batteries, and motors are needed, and especially some very fine electrical devices for cutting and separating minerals and for separating various kinds of ores. The college authorities have spent over $5,000 in electrical equipment and were able to get almost everything they wanted from Canadian firms. The machinery ordered is now arriving and will at once be placed in position under the supervision of Prof. Dupuis, dean of the Faculty of Science, and Prof. L. W. Gill, B.Sc., who has charge of the subjects of mechanical and electrical engineering. The growing importance of this new department of Queen's, for the erection of which the Ontario Government voted $35,000, may be partially understood when it is stated that there are at least fifty per cent. more students taking electrical engineering now than there were in the 1901-2 session.

QUESTIONS AND ANSWERS

"J. M.": What certificate is required of the men in charge of electric light plants?

ANS.—None at all as far as the electric machinery is concerned, but if it be driven by steam power it must be operated by a man who has the necessary certificates as a steam engineer; if driven by water power none are neccessary.

"Station Superintendent": Should the ammeters of my two generators be connected in the positive, negative or equalizer leads? Does it make any difference where the series coils are put, in the positive or negative sides?

ANS.—The series coils may be connected into either the positive or negative leads, as may be most convenient; and the ammeters must be connected into the lead of opposite polarity to that in which you put the series coils. If they are put in the same side they will not register that current which may be passing through the equalizer and the series field of the other generator. If inserted in the equalizer lead they will, of course, register only that current passing through it, which usually is but a small part of the load on the machine.

"Reader": What changes are necessary to make a 110 volt watt meter suitable for use on a 52 volt circuit, and vice versa, to make a 52 volt instrument register correctly on a 110 volt line?

ANS.—In the first case no changes are necessary, the instrument taking account of all changes in voltage and consequently slowing down to half the speed which it would run with the same current at 104 volts. Regarding the second point, a 52 volt instrument will register correctly on 110 volts, but as twice the normal current will pass though the potential coil it will very quickly burn out, so that it is necessary to insert in series with the potential circuit a resistance which should be of such a value as to increase the total resistance of this circuit to approximately twice its original amount, the constant on the dial being increased accordingly.

An eastern electric company write as follows: "What horse-power wheel is required to run a 5 k.w. exciter for a 200 k.w. S.K.C. generator? We wish to regulate our line voltage more owing to variations of speed of dynamo".

ANS.—The output of a wheel required to drive a 5 k. w. exciter at full load, allowing for the losses in the drive (belting, gearing, etc.,) and in the exciter itself, would be just about 10 h.p.,and this would be about as small a wheel as would, in ordinary cases, be desirable to install, though as it is the general practice to make the exciter somewhat larger than the exciting capacity actually required, you will doubtless find it possible to drive the exciter at the actual output required to excite the generator by a somewhat smaller wheel. For the exact exciting current and voltage required you should consult the makers of the apparatus.

"G. R.", Montreal: I want to operate a number of bells from a single push button, all of them to ring at the same time. How should I connect them, in series or in multiple? What way should the batteries be connected?

ANS.—You will probably find it best to connect all the bells in parallel, though it will perhaps take a little more wire. If they are wired in series all but one will have to have the interrupter taken off, all the making and breaking of the circuit being done at this one bell. Should anything go wrong with it none of them will ring, whereas if they are in multiple trouble with any one will not affect the remainder. Your batteries will have to be connected to suit the number and size of bells you use; you may need two or three sets in parallel, each set consisting of two, or perhaps three cells, connected in series. A much preferable method, if you have the necessary dynamo current available, is to operate the bells by connecting them in shunt to part of a suitable resistance connected across the circuit supplied from the dynamo, and thus do away with the battery entirely.

"Student": Why are temperatures relating to electrical machines nearly always measured in the Centigrade scale, when the type of thermometer in general use is the Fahrenheit? What is the rule for changing a reading from Centigrade to Fahrenheit?

ANS.—The Centigrade scale, as its name implies,belongs to the decimal system, which is recognized by engineers and scientists as much to be preferred to the many other tables and scales which it is designed to replace,and as it can be used in electrical practice without its adoption causing the confusion and enormous expense such as would accompany the introduction of decimal coinage into England,or the metric system of weights into this country, it is used by electrical engineers as one step towards the introduction of a universal and world-wide system of weights and measurements. To convert a Centigrade reading into a Fahrenheit multiply it by 1.8 and add 32, though it should be noted that this is not the correct rule for converting a RISE of temperature, which if expressed in Centigrade terms, should be multiplied by 1.8 only, without adding 32, to express it as a rise in Fahrenheit degrees. Thus a temperature of 40° C= 104° F.; a rise of 40° C = a rise of 72° F.

"Ordinary Reason": Can any one give a valid reason why the underwriters call for No. 16 flex-cord on drop lights? It appears that when they are already limited to the use of only one light on a cord that No. 18 cord would be miles big enough. It makes conspicuous and cumbersome something that it is desirable to look otherwise. If No. 18 cord will carry 5 lamps of 16 c. p. without any perceptible heat, and it is protected with a suitable fuse in the rosette and fibre lined sockets, what more can be required. It will yet come to No. 0000 cable protected with iron conduits covered with rubber hose taped and painted for 8 c. p. lamps, and the dear knows what for 16?

ANS.—You must have been misinformed on this point, as the rules allow the use of No. 18 flex cord, but not smaller, but as this style of wiring, owing to the exposed position which it occupies, is peculiarly subject to strains and pulls, nothing smaller than No. 16 is really mechanically safe. In this connection must be taken into account the fact that any break will affect both conductors, and thus be much more likely to cause a short than in other styles of wiring, and on top of this is the fact that in the great majority of cases it is the midst of material which is highly inflammable.

ELECTRICAL PLANT FOR THE McCLARY MANUFACTURING COMPANY.

The McClary Manufacturing Company, of London, Ont., who are now building a large new foundry and erecting shop at the foot of William street, adjacent to the Thames river, in that city, have decided to adopt electric power for the operation of their entire works. For this purpose they are now building a power station 100 x 56 feet, with coal house extension 40 x 50 feet situated about 200 feet from the new building. The plans for the power station were prepared by Messrs. Moore & Henry, architects, of London, and provide for a brick and steel structure, with concrete floors and a large pit for the condensing apparatus and feed pumps and heaters. The plans and specifications of equipment were prepared and the plant installed under the supervision of Mr. Roderick J. Parke, consulting electrical engineer, of Toronto.

The boiler plant will consist of a battery of three 100 h.p. Scotch internal-fired boilers, with Morrison suspension furnaces and equipped with Jones improved underfeed stokers. A 6x6 Robb-Armstrong automatic engine, furnished by the Robb Engineering Company, of Amherst, N.S., will drive the forced draft fan for the stokers. Provision is made for the installation of a fourth boiler when required. In conjunction with the boiler plant there will be a duplex mechanical induced draft equipment, thus dispensing with the necessity and expense of a high chimney. There will also be installed a 400 h. p. Green fuel economizer, and feed water heaters and purifiers of the latest approved type. The working steam pressure will be 160 pounds per square inch.

Every facility will be provided for obtaining and handling the fuel supply at the minimum of cost. A railway siding will extend by a trestle through the coal house and the coal will be dumped from the cars into a receiving hopper, thence distributed to the coal storage bins and when required will be carried by conveyors to the bunkers is the boiler room. The bunkers will have a total capacity of 60 tons, while the coal house will be capable of storing 600 tons. The coal handling machinery will be driven entirely by electric power.

The engine equipment will include a 12 and 20 x 14 inch tandem compound Peerless engine from the works of E. Leonard & Sons, London. This engine will be direct-connected to a 125 k. w. 250 volt direct-current generator of Westinghouse make. The unit will furnish power for the new factory and will be supplemented eventually by a similar 125 k.w. dynamo and engine to furnish power for driving the present factory, about one mile distant.

There will be installed at once a second unit consisting of a 10 x 10 inch Peerless engine and a 50 k.w. 250 volt direct-current Westinghouse generator. This will be used to furnish additional power for lighting when required and for the cupola blower service. This unit will be operated in parallel with the 125 k. w. unit for from two to four hours per day in taking care of extra load.

The distribution in the present and new factories will be by 250 volt two-wire system, with three-wire 500 volt transmission from the power station to the present factory up-town. It is expected that the power station will be in operation by April 1st, 1903. The instructions of the company to their engineer call for the design of a plant of the highest possible commercial efficiency commensurate with a reasonable expenditure, and it is expected that when completed this plant will rank as one of the most complete and up-to-date power station for a manufacturing establishment yet built in Canada.

ELECTRIC LIGHT INSPECTION.

The annual report of the Inland Revenue Department of Canada furnishes particulars regarding the inspection of electric light during the year ending June 30th, 1902. The fees for the inspection of meters were $16,373.75, and for registration of companies $5,055, making a total of $21,428.75. The expenses of inspection were $5,172.94, and there was expended on standard instruments the sum of $4,088.74, leaving a net revenue of $12,167.07. On July 1, 1902, the annual registration fees for electric lighting companies were reduced to $5 for companies having installation of 500 lamps and under, $10 for over 500 lamps and not exceeding 2,000 lamps, and $25 in excess of 2,000 lamps.

Of 12,276 electric light meters presented for inspection, 12,022 were accepted as coming within the error tolerated by law, 152 were rejected, and 102 were verified after first rejection. The following table furnishes the details:

Divisions.	Number Presented.	Verified as within the error tolerated by law.			Rejected.			Verified after First Rejection.		
		Correct.	Fast	Slow.	Unsound.	Fast.	Slow.	Correct.	Fast.	Slow.
Belleville	403	270	81	100						
Hamilton	688	320	231	136					1	
London	640	216	202	218		2				
Ottawa	2,036	384	849	1,000	7	8		9	1	5
Toronto	1,000	171	514	642		57	22			
Montreal	2,895	1,881	827	117	4	21	3	23	11	5
Quebec	1,029	400	374	252		1			1	1
Sherbrooke	27	8	1	18			2			
St Hyacinthe	88	88								
St John	491	108	111	272						
Halifax	656	434	109	60	1	11	1	13	2	3
Charlottetown	12	1	4	5						
Winnipeg	373	101	61	211						
Vancouver	797	187	196	361				5	1	11
Victoria	502	166	136	220						
Totals	12,179	4,415	3,850	4,020	12	103	31	50	25	26

The report shows that there are now registered in Canada 315 electric lighting companies, of which 200 are in Ontario, 49 in Quebec, 11 in New Brunswick, 24 in Nova Scotia, 3 in Prince Edward Island, 12 in Manitoba and the Territories, and 16 in British Columbia. The report of 1899 showed a registration of 276 companies, so that within three years 39 new companies have commenced business. Then existing companies, however, have obviously greatly extended their business, as the number of arc lamps operated increased during the three years from 10,960 to 12,884, and the number of incandescent lamps from 546,672 to 984,956. Estimating that one arc lamp is equal to ten incandescents, there were in use in 1899 the equivalent to 656,200 incandescents, and in 1902 the equivalent to 1,113,796 incandescents, an increase during three years of over 75 per cent.

The comparison may be carried further as showing the greater efficiency of the meters on the market to-day as compared with those manufactured three years ago. In 1899 196 meters were rejected out of a total of 5,762, whereas this year only 256 were rejected out of a total of 12,276 meters.

THE MONTREAL STREET RAILWAY COMPANY.

The forty-second annual meeting of the Montreal Street Railway Company was held in Montreal on Nov. 5th, Hon. J. L. Forget presiding. The report of the president and directors showed net earnings for the year of $911,032.27, as compared with $795,413.20 last year. Four quarterly dividends were declared, and after paying interest on bonds and loans and the city percentage, and transferring $100,000 to the fire insurance fund, there was a surplus of $965. The directors called attention to the fact that the operating expenses per cent. of gross earnings showed a substantial decrease. Several new extensions to the company's system, amounting to fourteen miles of track, were constructed and put in operation during the year and the rolling stock was increased by the addition of 29 motor cars.

The receipts in 1902 were $2,046,208, which is 7.66 per cent. more than in 1901 ; the operating expenses $1,135,176, an increase of 2.70 per cent. The net earnings were $911,032, or 14.54 more than in 1901. The net income per cent. of capital was 11.68. The passengers carried in 1902 were 49,947,467, being 3,205,807 more than last year.

The following table shows the number of passengers carried during the past eleven years and the operating expenses per cent of car earnings :

	Passengers Carried.	Operating expenses per cent. of car earnings.
1892	11,631,386	82.68
1893	17,177,952	79.00
1894	20,569,013	71.16
1895	25,877,758	59.20
1896	29,896,471	56.48
1897	35,047,317	55.05
1898	35,353,036	52.15
1899	40,196,493	55.23
1900	43,362,262	56.34
1901	46,741,660	58.82
1902	49,947,647	56.39

Mr. F. L. Wanklyn, general manager, gave a brief account of the precautions which were being taken against fire. Sprinklers and all modern appliances had been placed throughout the company's buildings, and it had been found from experience that it was cheaper to do their own insurance and to set aside a sufficient reserve fund for that purpose.

The old board of directors were unanimously re-elected, and at a subsequent meeting of the directors the following officers were chosen : President, Hon. J. L. Forget ; vice-president, Jas. Ross ; secretary-treasurer, W. G. Ross ; general manager, F. L. Wanklyn.

The city engineer of Winnipeg, Man., has been instructed to report as to the cost of constructing an electric railway from Winnipeg to the Stoney Mountain quarry. It is proposed to operate it under municpal control.

The Snowshoe Gold and Copper Mine, Limited, of Phoenix, B. C., are installing a 150 horse power hoist, which will be operated by electric power furnished by the Cascade Water, Power & Light Company. The plant of the latter company is now nearing completion.

The Sherbrooke Light & Power Company have completed a new dam at their power station on the Magog river. The dam is 150 feet long, with gate house and bulk head at the south end, where there are two steel tubes eight feet in diameter. One of these is reserved for future extension. There are fifteen gates on the dam, each 7 feet wide and 6 feet deep. The power provided by the dam is estimated from 1,500 to 2,000 horse power. The plans and specifications for the work were prepared by Mr. A. Sangster, superintendent for the company.

LARGE POWER DISTRIBUTION SCHEME IN SCOTLAND.

A bill has recently been sanctioned by Parliament which gives authority for an extensive power distribution scheme contemplating the supplying of power to the industrial region of the lower Clyde River in Scotland. The district covered by the bill includes that part of the Clyde Valley extending about ten miles on each side of the river and about twenty miles up and down stream from Glasgow. The area covered is about 700 square miles, and three generating stations will be erected to meet the demand for power. The scheme has been promoted by a group of manufacturers who desire to obtain cheap electrical power and who realize that this can be better done by joining in a common system than by each putting down his own generating plant.

This is the busiest part of industrial Scotland and contains about 1200 works, many of which are large iron and steel works, coal mines, shipbuilding yards, and chemical works. Some of these works will alone require more power than many of the local municipalities now provide for lighting purposes, and it was easily shown that it would be inadvisable for the separate boroughs to attempt to supply an amount of power involving so large an expenditure of capital.

The three generating stations are to be built at Motherwell, Yoker, and Crookston. The Motherwell station is located in the neighborhood of a large number of manufacturing works and in the centre of an extensive coal field and can be connected with the adjoining line of the Caledonia Railway. It is, also, in close proximity to the river Clyde, from which water for steam and condensing purposes can be obtained.

The Yoker station is also situated on the Clyde, near the line of the Lanarkshire and Dumbartonshire Railway, and is in close proximity to a large number of shipbuilding yards, works, and docks. Authority has been obtained to lay cables across the Clyde from Yoker to Renfrew, which will enable the works at Renfrew, and other works on the south side of the river, to be supplied from this station.

The third generating station will be situated near Crookston, on the Glasgow & Southwestern Railway, Canal line; but, owing to the arrangement allowing the company to cross the river, it will not be necessary to construct this station immediately.

The works from which the most urgent demands for power have been received are situated in the areas immediately surrounding the first two sites, and it is intended, therefore, to proceed with these stations first and to install in each a plant of about 4500 k. w. capacity. They will be so designed that they can be enlarged from time to time, as the demand requires. A radius of 14 miles from these stations covers practically the whole district in which the company will be allowed to distribute their power, but a large proportion of the works are located within a radius of six or seven miles of the stations. When the stations are in operation, they will probably be coupled together electrically, enabling them to share the loads and average up their power factors or to supplement or aid each other in any emergency. The capacities of the respective stations will ultimately be about 10,000 k.w. each at Motherwell and Yoker, and 5,000 k.w. at Crookston. By utilizing cheap sites for the stations outside of towns and near to the coal mines, it will be possible to generate power at a very low cost. Of the 710 square miles covered by the scheme, only 13 are at present supplied with electricity. It is said that over 300 manufacturers petitioned in favor of the proposition, and it is thought that many of the remaider petitioned in favor of the rival Caledonian scheme which was turned down. The carrying out of this mammoth scheme of power distribution will place the manufacturers of Glasgow on a footing to be compared to that of American manufacturers who are so fortunate as to be within range of our cheap water powers.

The authorized capital of the Clyde Valley Electrical Power Company is $4,500,000, with borrowing powers of $1,500,000. The total cost for plant on the transmission lines is estimated at over $2,000,000. The electrical apparatus, which will comprise polyphase alternating-current generators and transformers for high voltage power distribution, rotary converters for the supplying of direct current, etc., has been contracted for with the British Westinghouse Electric & Mfg. Company. Messrs. Strain & Robertson are the engineers of the Clyde Valley Electrical Power Company. Mr. Robert Robertson has recently spent a considerable period on the American continent investigating systems and methods of power transmission and distribution.

TYPE "R" PACKARD TRANSFORMER.

The Packard Electric Company, of St. Catharines, Ont., are placing on the market a transformer which they claim to be superior in every way to any transformer yet made. It is designated Type "R," and embodies a style of construction which not only makes the transformer much more compact than the old styles, but of much lighter weight. The space for ventila tion has been increased by a new adaptation of the coils, which have nearly three-quarters of their entire surface exposed and outside the core. The coils are so imbedded in insulated tape and other insulating material that ventilation seems almost impossible. The coils are assembled in two sets, each set enclosing one side of a single magnetic circuit, the core being placed partly within the coils. There is the same radiation in the secondary as in the primary. Mica is used throughout for the insulation, a feature peculiar to this new type.

The type "R" transformer is designed for oil or air cooling. It is regularly made for primary voltages of 1,000 and 2,000 and the secondaries are arranged for operating on 50, 100 and 200 volts in the small sizes, and 100, 200 and 400 volts in the large sizes, so that with a primary voltage of 2,200 all transformers over 150 lights capacity can be used for 440 volt motor installations.

STEAM-TURBINES.*

By S. E. Fedden, City Electrical Engineer, Sheffield, Eng.

The technical details of the steam-turbine have been very prominently placed before engineers lately in numerous able papers, and the author does not consider it necessary to go over this ground again. Suffice it is to say that the construction of the steam-turbine is simplicity itself, as it consists only of a hollow drum revolving in a stationary drum or cylinder, each with teeth or vanes attached, and so arranged that they clear each other. The two cylinders are steam packed, and, of course, the thrust guides require careful adjustment so that the vanes do not clash. Of late years this turbine engine has been meeting with signal success, and many engineers are now considering whether it is not destined to revolutionize the means of obtaining power from steam both by land and by sea. The author suggests, however, that engineers and inventors should turn their attention towards bringing to perfection gas-turbines, now that cheap gas is available, and the ideal engine, combined with the most economical way of obtaining electrical energy from coal, may then result.

The fundamental principle attending all methods of electrical working is implied by the word "velocity," a requirement eminently possessed by the dynamo, motor, and rotary converter, owing to the entire absence from these machines of reciprocating parts. This requirement, however, is not possessed by the prime mover—the modern reciprocating engine. Velocity was first obtained on the dynamo by means of belts or ropes, but this method of driving was soon discarded; it took up too much available floor space, and was an unsatisfactory and inefficient arrangement at the best. The attention, therefore, of the most prominent engineers in the world was directed towards increasing the speed of the engine, so as to adapt it for direct coupling to the high-speed dynamo or alternator. The efforts of these engineers were attended with very great success in Britain, and they were able, not only to couple their new high-speed engines to the dynamos, but they also obtained those qualities of economy and reliability of working claimed for the slow-speed engine with its belt drive, and the market now supplies high-speed engines of moderate sizes and of British manufacture which are second to none in the world.

The demand for electrical energy for all purposes has, however, increased by leaps and bounds, and has thus called for larger generators and larger engines with heavy reciprocating parts; therefore more strain and wear, bringing increased engine troubles. High-speed engines are now being built with pistons considerably over two tons weight. Such a piston will have to start and stop from 400 to 500 times per minute. When this enormous weight, making so many reversals per minute, is considered, it will not be difficult to imagine the steam-hammer effect obtained if the least thing goes wrong with the valve setting or the compression. On account of the increased engine troubles with high-speed engines, manufacturers are now falling back to moderate speeds, and many to slow speeds, although this is attended with an increased cost of the plant. Taking into consideration the large demands for electrical energy which must be made in the near future, it seems probable that the size of the generator and slow-speed engine will become unmanageable, also great difficulties will be experienced in shipping and erecting the same. The aim of all engineers should be simplicity, and the modern reciprocating engine, with its numerous complications, cannot by any means be considered the embodiment of this principle of simplicity. The great number of its moving parts, which require watching and adjustment, increases the cost of maintenance and attendance. Engineers who have had charge of power stations of from 6,000 h. p. to 10,000 h. p. are fully aware of the laborious and never-ending work and watchfulness required to maintain their reciprocating engines in fair running order; the station calls incident to the taking up of brasses, repairs and adjustments to valves, gland packing, cylinder lubrication, automatic governors, trip valve gears, and many other things, are items that go to build up the daily and nightly experience of the present-day station engineer. Engineers laying down new plant have to consider the increased cost of building, the larger floor space required, the longer lengths of steam and exhaust piping, valve-opening gears, and heavy cranes for lifting which are required in the case of large reciprocating engines, as against the requirements of a station laid out with steam-turbines. The massive nature of foundations, the time required for delivery and erection of large plants, are items which often seriously delay the speedy completion of contracts.

It was owing to these and similar reasons that the author's attention became directed towards the steam-turbine offering a possible solution of the difficulty, and a short experience with generators of this type has since formulated his belief that progress in the generation of electrial energy lies in this direction. The failure of the steam-turbine to secure earlier appreciation was probably due in great measure to that inherent conservatism to which British engineers are only too liable. Two years ago the author had the opportunity of going through the country to inspect all the larger turbine installations, and the conclusions then arrived at were: (1) it was inadvisable to put down a steam-turbine to exhaust to atmosphere; (2) it was inadvisable to put down a steam-turbine of a small size; (3) it would be policy to instal steam-turbines from 200 k.w. to 300 k.w. and upwards either for alternating or continuous current generation for lighting or power, provided there was a plentiful supply of cold water available for condensing purposes, and also provided that surface condensers were used, all the water being returned to the boilers.

From the year 1885 until 1890 nearly all the turbines manufactured were non-condensing of comparatively small type; they were not economical—in fact, many engineers called them steam-eaters, but great improvement, both in construction and design, has since been made in them, and this has led to a very much smaller steam consumption, so that there is now on the market a steam-turbine which, in the larger sizes, and in the matter of steam consumption, is capable of holding its own against any triple-expansion engine yet produced. Even in the early days, when they were considered steam-eaters, their smooth running and general adaptability to the driving of electrical machinery was the subject of much comment. The author, however, wishes to call the attention of the members to a few of the advantages which the adoption of the steam-turbine, when running under ordinary conditions for working in a power station, has impressed upon his mind. As many members are no doubt aware, a steam-turbine of 500 k.w. capacity, 100 cycles single-phase, was brought from the Paris Exhibition into the Sheffield station about 18 months ago, and was running on the town load within three days of the time of its arrival at the station doors, and within about three weeks of the date of the order by telegram. It was simply dropped down on the station floor, without any preparation in the way of foundations, and has since, over the period stated above, run more or less continuously and during longer hours than any other plant in the station. It runs in parallel with alternators both of the iron and copper type, with engines of the triple and compound type, and can be brought up to speed to meet the demand of a sudden load much more quickly than any other of the neighbouring plants. Boiler priming or wet steam simply causes momentary slackening of speed until the turbine clears itself of water. Other advantages are as follows: (1) Absolutely steady nature of turning moment. (2) Entire absence of cylinder lubrication, which, therefore, allows of all the condensed steam being returned to the boilers. The saving in this one item alone materially assists in the reduction of station costs. (3) The time occupied in cleaning down is

*Paper read before the Municipal Electrical Association.

brought to a mimimum, and is about one-sixth of that required with a reciprocating engine of similar capacity. (4) The entire absence of rubbing surfaces and packed glands within the steam-chamber will permit of the use of superheated steam without fear or injury. The turbine specially lends itself to the use of superheat of a high temperature, and in this respect possesses a considerable advantage over a reciprocating engine. (5) Exceedingly small costs for attention and repairs, and great reliability of working. These last items bring home to the engineer more forcibly than anything else the advantages of a purely rotary as opposed to a reciprocating motion. When considering the laying down of a steam-turbine plant, the main factors to be considered are:

FIRST.—Good vacuum in the condenser. This is even more necessary than with an ordinary engine, as the makers claim that the turbo expands the steam right down to the vacuum of the condenser. The following table of actual tests taken on a 500 kw. set illustrates how important it is to obtain a high vacuum:

CONSUMPTION OF 500 K.W. TURBO-ALTERNATORS, RUNNING AT 2,500 REVOLUTIONS WITH 140 LBS. STEAM PRESSURE AT THE STOP VALVE AND NO SUPERHEAT.

Vacuum constant from full load to no load. Inches of mercury.	Consumption per kilowatt-hour — Full load	Half load	Quarter load	No load
29	—	—	—	1,500
28	22.2	25.6	32.4	1,700
27	23.1	26.9	34.5	1,900
26	24.0	28.2	36.6	2,100
25	25.1	29.7	39.0	2,300
24	26.2	31.2	41.2	2,500
23	27.5	32.9	44.8	2,700
22	28.9	34.7	46.3	2,900

SECOND.—Arrangements for high superheat, as tests show that with 50 deg. F. of superheat, there is 8 per cent., and with 100 deg. F., 12 per cent. economy in steam consumption. From the tests taken on the 1,250 k.w. steam-turbine sets, which are now working satisfactorily at Elberfeld, in parallel with Sultzer engines, where the speed ratio is something like 16 to 1, it was shown that there was a gain of 12 per cent. with 55 deg. C. superheat, and that every inch of vacuum improves the steam consumption by 4 per cent. It was also shown that the steam consumption in the turbines, other things being equal, decreased constantly with increasing loads, whereas the Sultzer engines showed a less economy over three-quarter load.

The steam consumption in a turbine closely follows the right line law, or is proportional to the load added to a constant quantity which represents the consumption of steam at no load. The new 1,500 k.w. turbo-alternators which the author is installing at Sheffield power station will, with their own condensers, only occupy the space of 730 feet. The foundations will be of the simplest description, and the general compactness of the sets and the ease of erection are expected to effect a considerable saving of time and money. The appearance of the station will be improved by the absence of ugly lengths of steam-piping, or cylinders poised up in mid-air to obstruct the lighting of the building, and altogether the author hopes that there will be a general absence of that complexity of moving parts which to the trained eye of a station engineer offers so many possibilities of failure. The author has been severely criticized for starting a large power-house with steam-turbines, but time may show whether this criticism is deserved. At present, however, he feels quite confident, after considering the problem from all points, that the steam-turbine stands in a most favourable position when compared with reciprocating engines of large powers for the supply of electrical energy.

The exchange of the Bell Telephone Company at Ingersoll, Ont., is being enlarged and remodelled.

"Work Done" is the title of a book just received from the Westinghouse Companies Publishing Department. It contains a record of some of the work done in the field of high-speed inter-urban railway engineering by the firm of Westinghouse, Church Kerr & Company. The book is illustrated by half tones from photographs and by reproductions from working drawings.

THE DISTRIBUTION OF ARTIFICIAL LIGHT.

The Westinghouse Electric & Manufacturing Company, representing the Nernst Lamp Company, have issued a little booklet dealing with the distribution of light and setting forth the advantages of the Nernst lamp in this respect. The following extracts are taken therefrom :

The engineers who developed the Nernst Lamp kept in mind from the outset the importance of a correct distribution of light, and before determining the general form of the new lamp studied carefully the desirable and objectionable features of other illuminants. It was found that the horizontal rays from the arc lamp, for instance, were generally unsuitable, and after careful consideration, it was decided to make a more downward distribution of light from the Nernst Lamp. In this connection it is interesting to note what is found in Nature. The sun at rising and setting projects its rays horizontally into our eyes, but at such times the light is much softened and the intensity greatly reduced. During the working hours of the day, however, the sun reaches a position in which the light can be greatly intensified without injury or discomfort to one's eyes. Our eyes are well protected from these vertical rays, but are unsuited for light projected in a horizontal direction, and it is obvious that we are unaccustomed to a horizontal distribution of intense light in Nature; at the same time it is uncomfortably evident that horizontal distribution is found in the methods of street lighting now in vogue. This refers more particularly to the arc lamp, which throws an abundance of light horizontally along the street, much after the manner of a search-light or locomotive head-light, with the result that horizontal rays of great intensity are projected into the eyes of pedestrians, teamsters and horses.

In the Nernst Lamp it has been sought to avoid the error above described by more closely imitating Nature, and in a number of places where the Nernst Lamp has already been introduced for street illumination the results have been found wonderfully pleasing. The lamps have been placed at about the same elevation as the ordinary arc lights and at varying intervals, according to the size of the unit selected. The result is that instead of the unsteady horizontal beams and the dense shadows underneath the arc lamp, we have a soft white light evenly distributed over the street, to the great relief of the eye.

It is interesting to note the pleasing effects which are now being produced with the Nernst Lamp by using in large interiors only one quality of light, in distinction to the always unpleasant and inartistic combination of the bluish-white arc and the yellow incandescent. In this respect, the Nernst Lamp offers for the first time a uniform quality of light in all sizes of units, and is the only electric light capable of being made in a practical and efficient form for both high and low candle powers.

The first requisite of artificial lighting is a fair general illumination from above; then, if a reading or writing light is desired, it should be located well above the eyes and back of the reader so that the light will be cast over the left shoulder. As a writing light, the lamp may be placed well above the line of vision, preferably six feet from the floor and about a foot to the left of the writer's head, so that no shadow will be cast by the writing hand. The light should be thrown downward, giving a good general illumination over the entire desk or table.

To obtain the results above described has been the object of the makers of the Nernst Lamp, and it is very gratifying to note that users of light are already learning to appreciate the benefits to be derived from a lamp which has been so carefully designed with reference to a proper distribution of light.

Mr. Hartley Gisborne, a member of the Institute of Electrical Engineers, London, England, has received the appointment of electrical engineer for the Tyee Company, which is installing an electric system at the Tyee smelter in British Columbia.

A number of insurance underwriters recently made an inspection of the Hill automatic electric switch at the factory of the company, 426 St. Paul street, Montreal. The invention is intended to prevent electric fires due to high voltage and to grounding, and was endorsed by the underwriters as a step in the right direction.

Hon. Mr. Prefontaine has made the statement that there is no reason why the St. Lawrence channel should not be so lighted at night as to make it as navigable during the hours of darkness as it now is in the day time. He believes that an appropriation for the purpose will be granted by the Government and that the work of perfecting the lighting will be completed by the fall of next year.

LAKEFIELD AGAIN LIGHTED.

After an uncomfortable transition from electricity to coal oil for some weeks past, reminding the citizens in some degree of the Egyptian darkness of old, live Lakefield is once more rejoicing in the blessings of electric light. The current from the new company's power station was turned on for the first time on Tuesday evening at five o'clock. Business men, especially, are particularly happy, and are congratulating the new company on their enterprise. The success of the new light is already assured, and the encouragement shown by the number of users is taken as evidence of the appreciation of the long-felt want and the desire to encourage the promoters. The Farrer Bros., who have installed the plant, have done their work in a practical and up-to-date manner. The outfit is wholly new, and produces a brilliant, clear, white light. The rates, also, are said to be very moderate.—Peterboro Examiner.

Concerning the above a correspondent sends us the following communication :

The Farrer Brothers referred to last spring purchased from Madill Bros., of Lakefield, their old series arc and incandescent system. They have installed a complete new alternating current system in its place, comprising a 40 k. w. Royal electric alternator and exciter with switchboard, purchased from the Canadian General Electric Company. They have also adopted the very latest ideas in street lighting, using the C. G. E. enclosed a. c. arc lamps, eight in number at present, which are giving excellent satisfaction. The members of the new firm understand their business thoroughly and are to be congratulated upon their enterprise and perseverence, especially in the face of so much opposition in the first place.

Mr. Chas. L. Farrer, the elder member of the firm, and under whose supervision the new plant was installed, is well and favorably known to the electrical fraternity in Ontario and Quebec, but especially in the latter, having held responsible positions in nearly every department of the Lachine Rapids, Hydraulic and Land Company, Montreal. Mr. Farrer was with this company almost from its inception and grew up with it, so to speak, from its infancy to almost its present proportions, developing 12,000 h. p. He left to take charge of the high potential (10,000 volts) plant at Chaudiere Falls, Que. Just before severing his connection with this company to accept a tempting offer from the Montgomery Water Power Company, Alabama, Mr. Farrer took unto himself a life partner in the person of Miss Ethel Pruner, one of Morrisburg's fairest daughters, upon which occasion he was presented with a beautiful gold locket suitably engraved. Mr. and Mrs. Farrer shortly after left for their new home in Alabama, where Mr. Farrer was engaged to take charge of a 5,000 h. p. power house transmitting current to the city of Montgomery, 30 miles distant, at 30,000 volts. The huge stone dam of this company being washed away by flood last December, with no prospect of it being rebuilt in the near future, caused Mr. Farrer to return to Canada, deciding to locate at Lakefield. Lakefield people should congratulate themselves not only on the excellent light and service which we noticed on one of our recent trips to that progressive town, but also on having added to their population one so worthy of their esteem and confidence. Mr. L. L. Farrer, the younger member of the firm, while not having the experience of his older brother, is nevertheless clever at his business and was for a few years with Mr. Jas. Easton, inventor of the Easton Patents afterwards controlled by the Reliance Company. The Messrs. Farrer Bros. are sons of Police Magistrate Farrer, of Parry Sound.

BOILER EXPLOSIONS.

An instructor in science at the College of the Sorbonne, in Paris, has made a study of boiler explosions, a large portion of which he thinks to be due to the inefficiency of the safety-valves in common use. As he observes, a safety-valve which is held to its seat by a spiral spring, as is the case with those on small and cheap boilers, never shows at the valve, when open, a pressure so great, by many pounds to the square inch, as that which actually exists inside the boiler, for the reason that as soon as the valve opens in the slightest degree, the escape of a portion of the steam just under the value reduces the pressure of the remainder. Supposing the safety-valve be set to open, for example, at one hundred ponnds to the square inch, while it will begin to leak steam at that pressure, it cannot be held open until the boiler pressure is far beyond that, as the pressure required to hold it open must be one hundred pounds to the square inch plus whatever is lost under the valve by the escape of a portion of the steam. Moreover, as with a cheap valve, the force of a spiral spring increases greatly as it is compressed by opening the valve widely, while the wider opening of the valve reduces still more the local tension of the steam, it follows that to hold the valve up, so as to keep an annular opening around it equal in width to one-fourth the diameter of the valve, which is necessary to give free escape to the steam, requires a pressure inside the boiler far greater than that at which the safety-valve is set, the difference varying with the spring, the pressure and the size of the valve. In this country, the simple spring safety-valve is only used on the cheapest boilers, our engineers having long understood its defects, but M. Fournier's interesting paper will be useful, even here, as showing clearly the nature of the danger attendant upon its employment.

OUT FOR THE WORLD'S TRADE.

The Electric Repair & Construction Company, of Cleveland, Ohio, whose advertisement appears in this issue, is one of the new electrical concerns of Cleveland. At their works on Sheriff street they show a large line of dynamos and motors, also electrical and water fans, all of their own manufacture. They can supply electric machinery from ¼ h.p. to 10 h.p., also anything required in the electrical supply line. Their one h.p. machine is a marvel of neatness and strength. It has distinctive features in having no perceptible variation in speed from "no load" to "full load." This was demonstrated in actual trial by a representative of this paper. The speed on this machine is 1300 revolutions per minute, which is a very desirable speed. This high efficiency is the result achieved by the use of the very best materials obtainable and skilled electrical experts. The brush holders are direct acting. This company have recently organized, and are now fully equipped to attend to their ever increasing volume of business. They are turning out the various types of dynamos and motors in lots of a dozen at a time. It takes expert mechanics to do repair work, and they make a specialty of this branch of their business. Mr. E. Snyder, well known as an expert electrician, is the general manager of this company.

A GREAT VALVE INDUSTY.

At Sandusky, Ohio, is one of the largest valve manufactories in the world. It is that of the Vincent Valve Company, manufacturers of gate and globe valves, as well as all water-works specialties and a line of brass novelties. The immense plant of this company, while a comparatively new one, has recently been again increased by the addition of a large brass foundry. The people of Sandusky, through their wide-awake Chamber of Commerce, have shown their appreciation of such a great establishment in their midst and have given gratis to the company a valuable plot of land needed to increase the already large capacity of the works.

The Vincent Valve Company are now establishing representatives in all parts of the world to handle their goods. They are for the first time going into the export trade. With their new equipment, and employing three times the number of men employed last year, they are fully prepared to invade the foreign market.

While at the works our representative was very kindly shown through the vast establishment by Mr. E. C. Bacon, the very energetic secretary and manager. There were found to be orders on hand from the United States Government, a hundred expert mechanics being employed on this work alone. The Navy Department are great believers in the Vincent valves, solely on account of their peculiar construction. As a consequence they place their orders for valves required for their cruisers and battleships with this company.

The moulding and casting department shows a very busy scene—one casting our representative saw was three tons in weight. The workmen are divided into night and day shifts and the company are now advertising for additional expert brass and iron moulders.

Among their products is the Standard Globe, Angle and Radiator valves, as well as the heavy pressure line, which they fit with regrinding discs and seats. The Vincent adjustable wedge gate valves have become a fixture in the market, and their success is owing to the simplicity of their construction, small number of parts, superior workmanship and special metal mixture.

The Vincent Hub or Ball End straightway valve is one of the strongest valves of the gate pattern made. It is simple and durable because the friction is reduced to a minimum by its peculiar construction. They claim that it has a less number o joints of bearing than any other valve made. In the Vincent the stem nut has no duty to perform but to raise or lower the gates, the operation of seating the gates being performed by the adjustable wedge alone. By the use of the adjustable wedge all danger of stripping the threads is avoided.

The Vincent composition disc globe and angle valves are designed for working pressure up to 160 lbs., and are regularly fitted with composition discs, made expressly for the Vincent Company from the best formulas known. The metal is their own special mixture and the workmanship and finish are not excelled. They also fit these valves with a reversible metal disc. Each valve is carefully tested before leaving the works and they guarantee them to be superior to any on the market.

Their heavy pressure valves are fitted with an outside screw case and inside screw bonnet, which has a double seat at the top edge of the case and at closing joint at outside. It is an impossibility to strip the thread without it being discovered. Expansion of metal under great temperatures tightens the joints instead of causing them to become loose, as in the old fashioned valve, a difficulty overcome which will be appreciated by all users.

SPARKS.

A by-law was carried recently by the ratepayers of Goderich, Ont., authorizing the council to take $50,000 of stock in the Huron, Bruce and Grey Electric Railway Company.

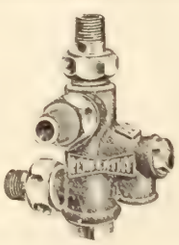
The Modern Telephone Company, of Hamilton, Limited, have issued their stock book. The capital is placed at $300,000, $70-,000 of which has been subscribed by Messrs. O. W. Rogers, J. T. King, W. A. Johnson and H. A. Drummond, of Toronto, and J. A. Scovell, of Lewiston, N.Y.

The Bell Telephone Company have made a new agreement for a telephone system in Hull, Que. For business telephones the charge will be $45 and for private telephones $30. The city will have four telephones at $25 each. Six public telephone stations will be established at places to be named by the council.

At Sault Ste. Marie, Ont., there are 406 telephones installed. When Mr. Burrows, the present manager, assumed his duties there about two years ago, the exchange comprised only 125 instruments. It is understood to be the intention of the Bell Company to remodel the exchange and to install the improved type of battery.

A syndicate of Toronto capitalists, including Mr. Wm. Mackenzie, president of the Toronto Railway Company, and Mr. Frederic Nichols, managing director of the Canadian General Electric Company, have approached the commissioners of the Queen Victoria Park with a view to securing privileges for the development of electric power at Niagara Falls. The new company desires to establish its works between the plants of the Ontario Power Company and the Canadian Niagara Power Company. One of the chief objects aimed at is to secure a portion of the power developed at the Falls for Toronto and other Canadian cities.

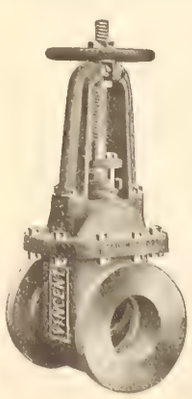
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Sandusky, O., U.S.A.



MONTREAL

Branch office of the CANADIAN ELECTRICAL NEWS,
Imperial Building.

MONTREAL, December 4th, 1902.

The Montreal Light, Heat & Power Company are in hard luck again. For the second time a portion of the Chambly dam has been swept away. Owing to the accident happening on a Sunday the company's officials got their steam reserve to work and carried the lighting load Sunday evening. It is a question if any of the general public were aware that there was a serious mishap until they read the news in the Monday morning papers.

What is happening to the competent wireman who used to exist, who worked hard, and studied his employer's interests? He is indeed becoming a "rara avis" and unfortunately college training does not breed the species. There is good money and plenty of open situations for the wireman of the right stamp.

A "thriller" at one of the local theatres advertised the wireless telephone among the other numerous attractions(?) Bellowing through a megaphone from the wings, however, filled this scientific invention.

The demand for electrical toys as Christmas presents is on the increase, yet no manufacturer seems to turn out a really good line of such. Surely there is room?

Fred Thomson's high tension transformer for Marconi is evidently O. K., as Fred has just come back from Sydney and reports orders for more transformers.

Mr. Harry Holgate, of Ross & Holgate, consulting electrical engineers, who has been located heretofore in Toronto, is moving his quarters to Montreal, to be of more direct assistance to his partner, Mr. R. A. Ross. Work is flowing in to the firm.

The Lachine Rapids Company suffered the loss of a large transformer in their sub-station lately, the result, it is said, of a short circuit. Although some circuits were shut down momentarily, the light was on again in about twenty minutes. Quick work.

The new suite of offices of the Canadian General Electric Company are a marked improvement on the old and the feature of having the stock in the same building is one that should be more convenient for their Montreal staff and appreciated by their patrons.

The high tension and distributing switchboard in the new sub-station of the Montreal Light, Heat and Power Company, which is being installed by the Canadian General Electric Company, is nearing completion. It is hoped that a descriptive article on this switchboard will appear in the NEWS when the work is done.

300,000 PENBERTHY INJECTORS.

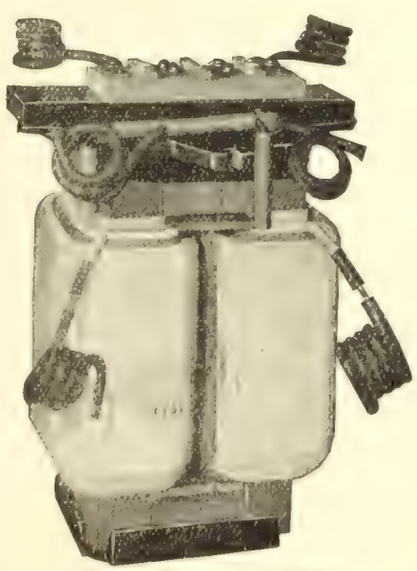
The Penberthy Injector Company, of Detroit, was organized in 1886 and soon after began in a small way the manufacture in Canada of their popular injector. This was done more with a view to protecting their Canadian patents than with any great business expectations, but the merit of the Penberthy injector soon created a demand which has resulted in a very large business.

The business soon outgrew its rented quarters in Windsor, Ont., and in 1901 land was purchased nearer the centre of the city, upon which is now erected a modern factory, with over four times the capacity of the old one. With the erection of the new factory the present company at Detroit decided to cast the Canadian branch adrift, and make of it a separate company. They applied for a charter for the "Penberthy Inspector Company, Limited," which was granted by the Ontario Government for the purpose of manufacturing brass injectors, oil and grease cups, water gauges, gauge cocks, lubricators and a complete line of steam specialties.

The trade of the Penberthy Injector Company extends to all parts of the world, and in addition to branches in London and Australia they have representatives in all the large countries in Europe and Asia. The sales of injectors in Canada and the United States alone reached the enormous total of over 300,000, which places the Penberthy in the front rank and makes the company the largest manufacturers in the world.

Some persons may not know that the Penberthy is manufactured in Canada, but their advertisement in this issue will put them right in that respect. This up-to-date and wide-awake concern are always glad to give information to engineers concerning their line of goods. A complete 70-page book has been issued and will be sent free to anyone interested.

Pittsburgh Transformers



THE TYPE K TRANSFORMER
(Core Type.)

When you consider the well known
reliability and efficiency of the
Pittsburgh Transformer
and
the promptness and care which the
Pittsburgh Transformer Company has
always given to orders for their
goods,
can you not see that it
will pay you to use them?
Having taken the general agency
for the Pittsburgh Transformer
we solicit your
patronage.

General Agents for Canada

The R. E. T. PRINGLE CO., Limited

105 Prince William St.,
St. John, N. B.

172 Dalhousie St.,
Montreal.

18 Toronto St.,
Toronto, Ont.

SPARKS.

The Toronto Railway Company are said to have decided to use iron poles exclusively in future, as they find them more economical and satisfactory.

The Ontario Government has received plans for an extension of the Sandwich, Windsor and Amhersburg Electric Railway south a distance of 5½ miles along the Detroit river.

Messrs. E. E. Slight, J. F. Cattermold, M. D., and W. D. Taylor, of Toronto, and A. A. Mahaffy, of Bracebridge, have been incorporated as the Standard Meter Company, Limited, with a capital of $60,000.

In the case of S. T. Willett, of Chambly, against the Chambly Manufacturing Company, the judge has awarded the plaintiff damages to the amount of $9.247.76 and ordered the defendant to construct a crib throughout the entire width of the river to protect the dams, piers and other works of the plaintiff.

The Harbor Commissioners of Montreal are considering the question of installing an electric plant. The operation of the grain elevator will require over one thousand horse power, and there will be cranes and numerous other machines which will require a large amount of electrical energy. If a plant is not installed current will be obtained from one of the existing power companies.

Clarkson School of Technology Thos. S. Clarkson Memorial Potsdam, N.Y.

Courses leading to degrees of Bachelor of Science in Civil, Electrical and Mechanical Engineering, comprising four years of thorough training and resident collegiate work in theory and practise of engineering. Well equipped shops, laboratories, drafting rooms and power plant. Located near Massena and the engineering developments along the St. Lawrence River. Healthful climate. Tuition moderate.

WM. S. ALDRICH, Director.

ELECTRICAL REPAIRS

In the large and well equipped factories where the manufacture of electrical apparatus is carried out under the piece work system, they find that repair work on apparatus sent in to be repaired or rewound interferes with this system, and in many cases they would prefer not to do this kind of work, as it is almost impossible to do it with dispatch and at a reasonable price. Knowing the above to be a fact,

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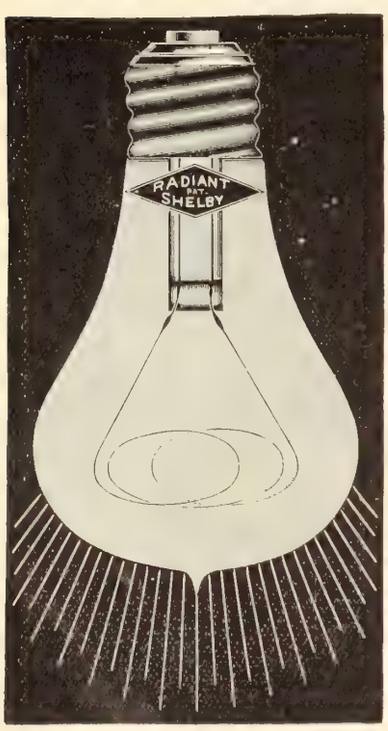
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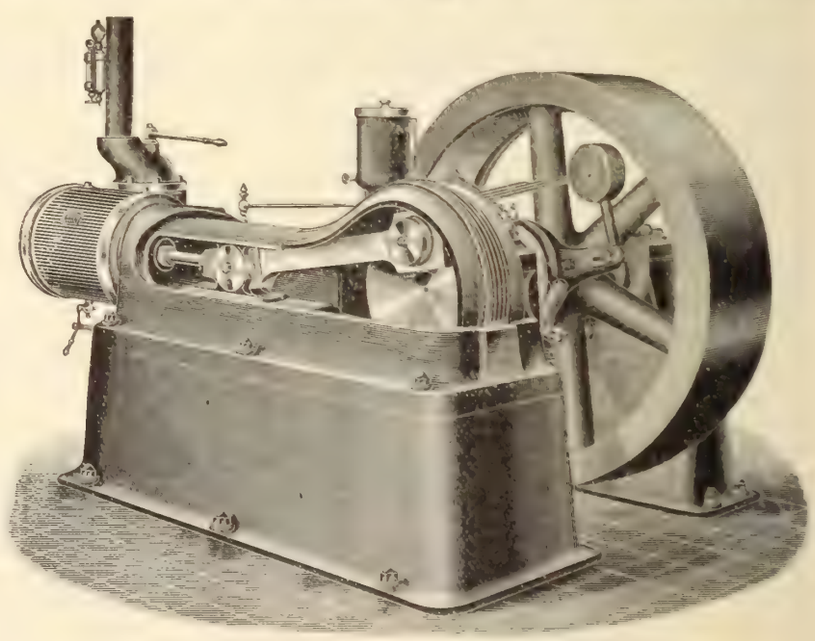
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SPARKS.

The Oxley-Enos Company, Limited, manufacturers of electrical and gas fixtures, have opened offices on King street west, Toronto.

An electric lighting and steam heating plant will be installed in the new hotel now being built by the Canadian Pacific Railway at Field, B. C.

Mr. C. J. Miller, of Orillia, Ont., has installed in his leather tannery a 5-horse power motor, furnished by the R. E. T. Pringle Company, Montreal.

Fire on November 10th did damage to the extent of $5,000 in the motor room of the Lake Superior Power Company's reduction works at S ult Ste. Marie, Ont. Motors, switch-boards and other electrical appliances were damaged.

Hon. Charles J. Doherty and Messrs. M. J. Doherty, George H. Hill and C. A. Bernard, of Montreal, have been incorporated as the Hill Electric Switch Company, with a capital of $10,000. Power is given to manufacture and sell electrical machinery and supplies.



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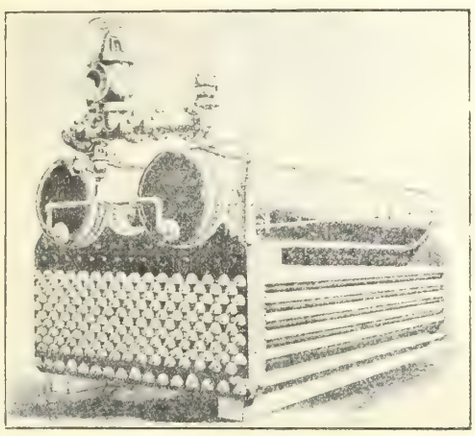
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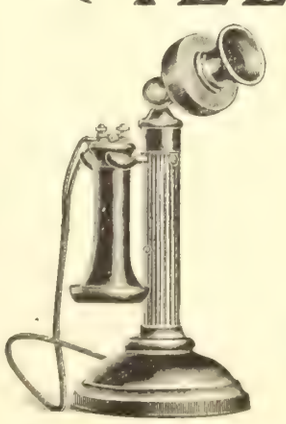
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SPARKS.

A telephone system will likely be installed at Queen's University, Kingston.

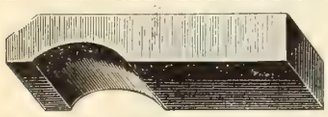
Mr. J. E. Bull, manager of the Bell Telephone Company at Guelph, Ont., for the past three years, has been transferred to Calgary, N.W.T.

Hon. Thomas Greenway has installed a private telephone system connecting his residence at Crystal City, Man., with his farm and the station.

The Ottawa Electric Railway Company are installing a new system of heating for their car sheds on Albert street. The hot air will be obtained from the Ottawa car company's shops and drawn into the shop by means of large fans, to be operated by electric motors. The pipes through which the air will pass are about one foot in diameter.

The town council of Minnedosa, Man., have accepted the proposition of E.S. Harrison, of Winnipeg, to install an electric light plant for the town. Mr. Harrison agrees to equip and maintain a system costing not less than $15,000, and to supply 1,800 candle power arc lights at $90 per annum and incandescent lights at the same rate as is charged in Neepawa. The town grants him an exclusive franchise for ten years and donates sufficient land on which to build a power house. At the end of ten years the town may buy the plant at a price to be fixed by arbitration.

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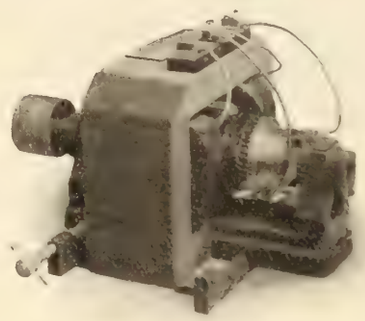
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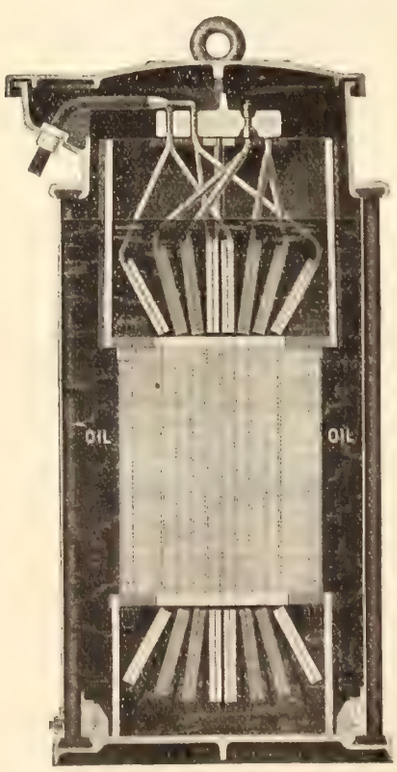
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SPARKS.

The Toronto Street Railway Company have just finished the work of welding the rails on Church street so as to make a continuous rail between various intersections of King, Queen and Carlton streets. In other sections of the city similar work is under way. It is claimed that by this means there is a saving in electric power equal to $50 per car per year.

The electric light and gas plants in the town of Owen Sound, Ont., are to be taken over by the corporation, an agreement to that end having been reached. The Owen Sound Electric Illuminating & Manufacturing Company will realize $33,400 for their electric plant, and the Owen Sound Gas, Light & Fuel Company $38,600 for their gas plant, making a total of $72,000 for the two plants. Both the company and the corporation recognized the advisability of avoiding arbitration.

The corporation of Vernon, B.C., is building a power house.

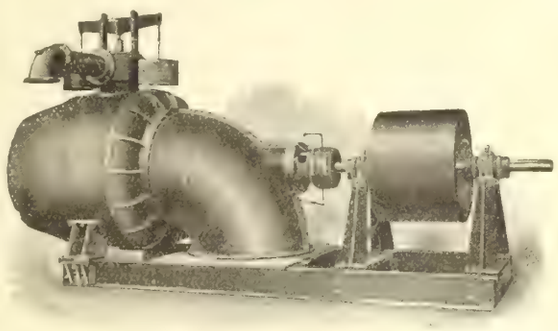
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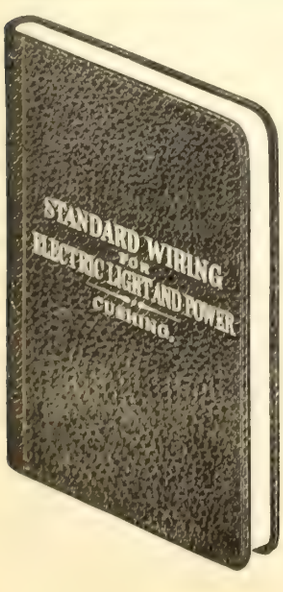
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SPARKS.

The Winnipeg Street Railway Company are installing another boiler in their power house.

Mr. E. S. Harrison, of Winnipeg, has installed an electric light plant at Carman, Man.

The ratepayers of Listowel, Ont., will vote on a by-law in January to take over the waterworks and electric light systems of the town and operate them under municipal control.

At the next session of the Ontario Legislature a charter will be asked for by the Lac Seul, Rat Portage & Keewatin Electric Railway Company, with power to build and operate an electric railway between Lac Seul and the Mikado Mines, passing through Rat Portage, Norman and Keewatin.

Seven of the new buildings to be built in Montreal by the Canadian Pacific Railway are now completed or under way. While electricity will be the motive power, it has not yet been decided whether the company will install a plant or take current from an outside company.

The DeLano-Osborn Engineering Company, of Toronto, has been incorporated, with a capital of $10,000, to carry on the business of civil, mechanical, electrical and mining engineering. The members include Milton DeLano, of Toronto, and F. C. Osborn and W. O. Henderer, of Cleveland, O.]

Under the guidance of Prof. C. H. C. Wright, about two hundred students of the School of Practical Science recently made an inspection of the development work now being done to generate power at Niagara Falls. Associated with Prof. Wright were Messrs. F. W. Sinclair, F. A. Gaby, C. J. Manson and L. W. Morden, representing the different years.

Preliminary arrangements have been completed for the construction of an electric railway 45 miles long from London to Port Burwell, Ont. The company undertaking this work is the Aylmer Construction Company, Limited, of Detroit. The incorporators are largely composed of Detroit and New York capitalists.

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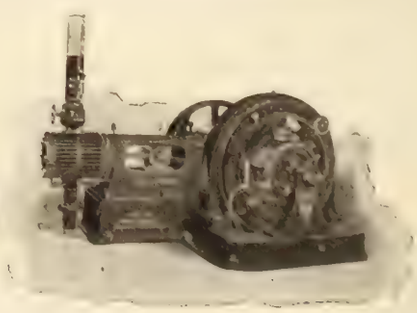
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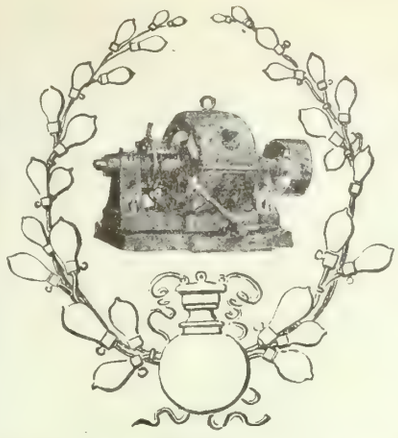
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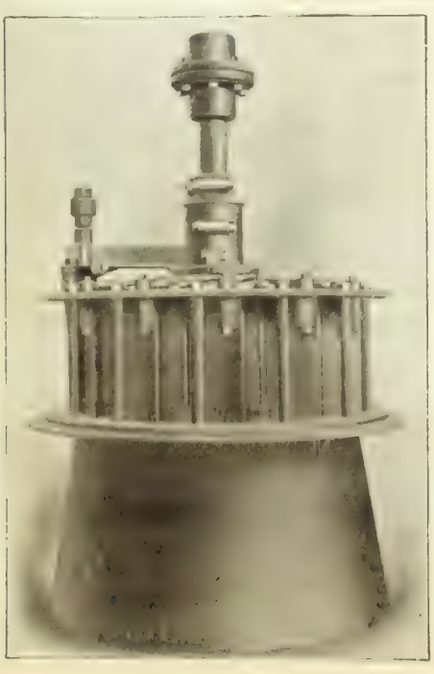
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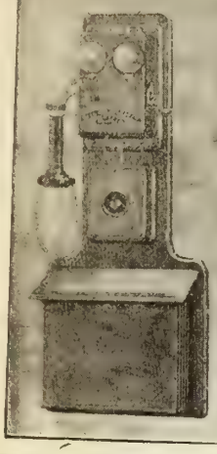
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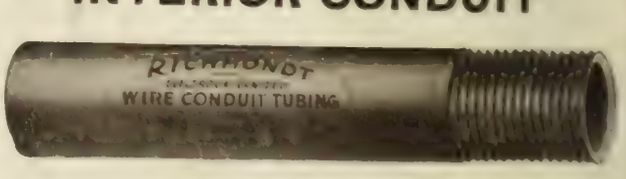
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